FACTORS ASSOCIATED WITH THE ACADEMIC ACHIEVEMENT

OF FOREIGN GRADUATE STUDENTS AT THE

UNIVERSITY OF MICHIGAN

FROM 1947 TO 1949

by

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A dissertation submitted in partial fulfillment
of the requirements for the degree of
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PROBLEM

The major purpose of this study was to discover factors associated with the academic achievement of foreign graduate students. An extensive survey of the literature revealed that there was insufficient knowledge with respect to the qualities that distinguish promising from less promising applicants for graduate study. The chief value of the present endeavor probably lies in the contribution it may make to the better selection of those foreign students who will profit most from graduate training. The conclusions as set forth in this project have emerged from the present inquiry into the achievement of foreign students enrolled in the Horace H. Rackham School of Graduate Studies of the University of Michigan during the academic years 1947 to 1949, inclusive.

PROCEDURES EMPLOYED

The principal sources of data are located in the office of the University's International Center, the office of the Registrar, and the Records Office of the Graduate School. These data were analyzed to determine the predictive relationship of selected personal, scholastic, and psychological factors to the academic achievement of the 587 foreign graduate students in the population represented in this project. Of this number, 257 were on probation at some time within their academic study. The remaining 330 were not on

probation and therefore served as a "control" group. The chi-square, the Fisher-t, and analysis of variance were the principal statistical techniques used in order to determine the presence of any significant differences in the characteristics of the two groups.

CONCLUSIONS

Only the more important conclusions which emerged from the procedures described above will be mentioned here. They are as follows:

1. There was no significant association between achievement and such variables as sex, entering age, employment status, and summer school attendance.

2. There was a predictive relationship between achievement and such variables as marital status, type of admission, degree held at admission, and length of residence in the graduate school.

3. There was a significant relationship between geographical area and achievement. Students who came from the Near East, Latin America, and the Far East were more likely to incur probationary status than were students who represented other geographical areas.

4. There was a significant relationship between the field of study and achievement. Students who majored in the social sciences and physical sciences were more likely to incur probation than were the students who majored in other broad academic areas.

5. Some significant differences were found in the comparative performance of probationary and non-probationary students on the Miller Analogies Test and the Academic Aptitude Examination, Graduate Level. Almost without exception, the differences obtained favored the non-probationary students.

6. Finally, it should be noted that foreign students, by and large, were more likely to experience academic difficulties during the first and second enrollments than at any other time during their subsequent residence in the graduate school.

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This project would not have been completed without the helpful cooperation of several individuals. The writer takes great pleasure in acknowledging his indebtedness to the following persons:

To Dr. Harlan C. Koch, chairman of the doctoral committee and the writer's major professor, warmest feelings of gratitude are expressed for his continued help and encouragement throughout the course of this study. Without his assistance this project would have never been completed.

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for granting access to the transcripts on file for the entire array of individuals in this study.

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DEDICATION

This study is gratefully dedicated
to the Reverend Timothy Hountras whose con-
tinued faith as father, counselor, and friend
has been a constant source of inspiration in
the life of the writer.

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CHAPTER I

NATURE OF THE PROBLEM

INTRODUCTION

American colleges and universities have for years been host to foreign students. As early as 1784 Francisco de Miranda of Venezuela and Colombia came to the United States and enrolled at Yale University. As far as can be determined, he was the first of many foreign students who were to come to the United States for study.[1]

It was not until the 1920's, however, that any appreciable number of foreign students was found in American higher institutions of learning. In the academic year 1923-24, there were 6,739 college students from abroad. In 1930, this number had increased to 9,643 and by 1948 there were over 26,000. The latter figure included students representing no fewer than 151 different countries.[2]

During the academic year 1948-49, Canada was credited with 16.5 per cent of the 26,759 foreign students who were enrolled in American institutions that year. China was second, with 15.4 per cent. India was third with 5.9 per cent. Then

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[1]Institute of International Education, Education in One World. Census of the Foreign Student Population of the United States, 1948-49, p. 32.

[2]Institute of International Education, Education in One World. Census of the Foreign Student Population of the United States, 1949-50, p. 16.

came Mexico, Cuba, the Philippines, Turkey, Norway, Colombia, and Iran in that order. During this same period, the following countries were represented by only one student: Albania, Armenia, Belgian Congo, Gambia, Guadalupe, Indonesia, Malta, Madeira, Martinique, Tanganyika, and Tunisia.[1]

Not only do foreign students come from widely scattered areas of the world, but an examination of what they study reveals a wide array of fields of specialization. The Engineering Sciences lead, with 20.2 per cent of the total number of foreign students; the Liberal Arts are second, with 14.1 per cent; the Medical Sciences and the Social Sciences are third and fourth, respectively, each having approximately 10 per cent. Then follow the Physical Sciences, Business Administration, Religion, Education, Agriculture, and the Biological Sciences, in that order.[2]

An examination of where these students were enrolled during this same period reveals that Columbia University ranked first in numbers of foreign students, having 1,140. The University of California at Berkeley was second, with 971, followed by Michigan, New York, and Harvard Universities with 818, 724, and 631, respectively.[3]

These additional observations about the foreign student

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[1]Institute of International Education, Education in One World. Census of the Foreign Student Population of the United States, 1948-49, p. 10.

[2]Ibid., p. 27.

[3]Ibid., p. 40.

population might well be made:

> Three men students came to the United States this year for every woman who ventured to cross the ocean in search of knowledge. The youngest foreign student is 16 and the oldest is 68, possibly proving that age is no barrier to the search for international understanding. The average age is almost exactly 25. Slightly more than one-half of the foreign student body are undergraduates.[1]

That the United States government has a deep concern in encouraging students from other lands to come here may be gleaned from statements made by former President Harry S. Truman:

> We must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas.... The United States is preeminent among nations in the development of industrial and scientific techniques. The material resources which we can afford to use for the assistance of other peoples are limited. But our imponderable resources in technical knowledge are constantly growing and are inexhaustible. I believe that we should make available to peace-loving peoples the benefits of our store of technical knowledge in order to help them realize their aspirations for a better life.[2]

It has been pointed out that a little more than one-half of the foreign students are undergraduates. The remainder have already received baccalaureate degrees from their native colleges and universities but wish to pursue graduate work in a given field. It is with this latter group that this study is concerned.

Administrators, teachers, and academic counselors can

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[1] Ibid., p. 8.

[2] Harry S. Truman, Inaugural Address, Washington, D. C., January 20, 1949. Published in Vital Speeches, XV (February 1, 1949), 227.

readily attest to differences in scholastic achievement among foreign graduate students. Some of them experience a minimum amount of difficulty and attain their educational objectives rather easily. Others, however, experience considerable difficulty and may or may not attain their educational objectives. The writer, who is a graduate student at the University of Michigan, has met many foreign students who are failing in their studies. Invariably these students state that they have "lost face," that they dread to return to their native countries as "utter failures."

To what may the failure of these students be attributed? Stated somewhat differently, are there any attributes which specifically characterize those foreign students who experience academic difficulties in their graduate studies at the University of Michigan? This study seeks to answer these questions.

STATEMENT OF THE PROBLEM

Stated more succinctly, the specific problem with which this study is concerned is the predictive relationship of selected factors to the academic achievement of 587 foreign graduate students who were enrolled in the Horace H. Rackham School of Graduate Studies at the University of Michigan during the academic years 1947 to 1949, inclusive. Of this number, 257 were on probation at some time within their academic study. The remaining 330 were not on probation and serve as a "control" for the comparisons made.

TIMELINESS OF THE PROBLEM

The literature on the academic success of foreign students in the United States is sparse. The writer became aware of the need for more information concerning foreign student achievement through his participation in a recent study of foreign students sponsored by the Association of Graduate Schools and directed by Dean Ralph A. Sawyer of the Graduate School.[1] This study will be reviewed in the chapter on related literature.

The present investigation is an outgrowth of the foregoing study. The writer felt that an intensive analysis of academic success within a single graduate school might bring to light factors related to achievement that were not brought to light in the study just referred to. It is hoped that the present project will enable administrators to select with more assurance those applicants from abroad who will profit most from graduate training.

DELIMITATIONS

The reader should be informed of the limits within which the findings were obtained. Four major limitations are discussed below:

1. The factors selected for study were those which the writer felt would be meaningful in predicting academic achievement. Data on these factors were readily available

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[1] To be reported in the _Proceedings_ of the Association of Graduate Schools, 1953-54.

and would yield to statistical treatment. In passing one may say that many of the variables chosen are reported in other predictive studies.

2. No attempt was made to study the predictive relationship of the factors selected to the academic achievement of American graduate students.

3. Only the foreign students who were enrolled in the Horace H. Rackham School of Graduate Studies during the academic years 1947 to 1949, inclusive, were retained in the study. To be included, each student must have completed at least one course for credit. Thus, students who were enrolled as "Visitors" or those who dropped out within their first enrollment were excluded.

4. Grades earned in each course were the sole criterion of academic success. The writer is well aware of the limitations of such a criterion. Nevertheless, grades have validity for our purpose because they determine whether or not a student is to continue in school.

BASIC ASSUMPTION

The underlying hypothesis is that there is a predictive relationship between such factors as personal background, scholastic record, and psychological test data, and the academic achievement of probationary foreign graduate students.

Sub-Hypothesis I

There is a predictive relationship between the following personal factors and academic achievement:

1. Sex
2. Age upon admission
3. Marital status
4. Native country
5. Native country broadly classified
6. Employment status
7. Type of admission
8. Degree held at admission
9. Admission with or without financial aid (scholarship, fellowship)

Sub-Hypothesis II

There is a predictive relationship between the following scholastic factors and academic achievement:

1. Degree received at the University of Michigan
2. Enrollments during which first, second, third, and fourth disciplinary actions were received
3. Field of concentration
4. Number of times on probation
5. Field of concentration broadly classified
6. Number of hours attempted during first four enrollments
7. Total number of hours attempted
8. Number of hours earned during first four enrollments
9. Total number of hours earned
10. Length of residence in the graduate school
11. Attendance at summer school
12. Cumulative grade-point ratio

Sub-Hypothesis III

There is a predictive relationship between the scores on the following psychological tests and academic achievement:

1. Miller Analogies Test
2. Academic Aptitude Examination, Graduate Level

COLLECTION, TABULATION AND SOURCE OF DATA

Collection

The data for this study were collected during the first semester of the academic year, 1953-54. The population consisted of the entire array of 596 foreign students who

were enrolled in the Graduate School of the University of
Michigan for the academic years 1947 to 1949, inclusive, but
not during the semester in which the data were collected.
However, five of the 596 individuals were "Visitors" and re-
ceived no credit for the work pursued. These were excluded,
as were four others who dropped all courses during their
first enrollment. Thus the original number was reduced to
587 students, 257 of whom were probationary and 330 non-
probationary. Tables I and II show the distribution of these
students by native country and field of concentration,
respectively.

TABLE I

DISTRIBUTION OF PROBATIONARY AND NON-PROBATIONARY FOREIGN GRADUATE STUDENTS BY SEX AND NATIVE COUNTRY

Native Country	Men		Women		Total	
	Proba-tionary	Non-proba-tionary	Proba-tionary	Non-proba-tionary	Proba-tionary	Non-proba-tionary
Argentina	---	1	---	---	---	1
Australia	---	---	---	1	---	1
Austria	---	5	---	---	---	5
Belgium	1	1	---	---	1	1
Bolivia	---	1	---	---	---	1
Brazil	2	3	---	2	2	5
British West Indies	1	---	---	---	1	---
Bulgaria	1	---	---	---	1	---
Burma	---	1	---	1	---	2
Canada	13	33	1	8	14	41
Chile	---	2	---	---	---	2
China	90	101	19	16	109	117
Colombia	3	3	---	---	3	3
Costa Rica	---	1	---	---	---	1
Cuba	1	2	1	---	2	2

TABLE I (Continued)

Native Country	Men		Women		Total	
	Proba-tionary	Non-proba-tionary	Proba-tionary	Non-proba-tionary	Proba-tionary	Non-proba-tionary
Czechoslovakia	---	---	---	1	---	1
Denmark	---	1	1	---	1	1
Dominican Republic	1	---	---	---	1	---
Ecuador	1	---	---	---	1	---
Egypt	4	14	---	1	4	15
England	2	---	1	---	3	---
Finland	---	1	---	---	---	1
France	2	3	---	1	2	4
Germany	3	1	---	---	3	1
Greece	1	1	---	---	1	1
Guatemala	1	---	---	---	1	---
Haiti	---	1	---	---	---	1
Holland	2	3	1	---	3	3
Hungary	---	2	---	---	---	2
India	33	53	6	6	39	59
Iran	4	1	1	---	5	1
Iraq	5	4	---	---	5	4
Israel	---	2	---	---	---	2
Italy	1	1	1	---	2	1
Japan	---	---	---	1	---	1
Korea	---	1	---	2	---	3
Malaya	1	---	---	---	1	---
Mexico	3	---	1	---	4	---
Nicaragua	1	---	---	---	1	---
Norway	---	1	---	---	---	1
Panama	---	---	1	1	1	1
Paraguay	---	1	---	---	---	1
Peru	4	---	---	---	4	---
Philippines	2	7	4	7	6	14
Poland	---	1	---	---	---	1
Roumania	---	---	1	---	1	---
Russia	1	3	---	---	1	3
Siam	---	---	---	1	---	1
South Africa	---	1	---	---	---	1
Spain	1	1	---	---	1	1

TABLE I (Continued)

Native Country	Men		Women		Total	
	Proba-tionary	Non-proba-tionary	Proba-tionary	Non-proba-tionary	Proba-tionary	Non-proba-tionary
Sweden	---	1	2	---	2	1
Syria	---	1	---	---	---	1
Turkey	25	16	---	1	25	17
Venezuela	4	3	1	1	5	4
Yucatan	1	---	---	---	1	---
Total	215	279	42	51	257	330

TABLE II

DISTRIBUTION OF PROBATIONARY AND NON-PROBATIONARY FOREIGN GRADUATE STUDENTS BY SEX AND FIELD OF CONCENTRATION

Field of Special-ization	Men		Women		Total	
	Proba-tionary	Non-proba-tionary	Proba-tionary	Non-proba-tionary	Proba-tionary	Non-proba-tionary
Aeronautical Engineering	5	6	---	---	5	6
Anatomy	---	2	---	---	---	2
Anthropology	---	1	---	---	---	1
Architecture	---	1	---	1	---	2
Astronomy	1	---	1	---	2	---
Bacteriology	3	---	---	1	3	1
Biological Chemistry	3	2	1	4	4	6
Botany	1	---	1	---	2	---
Chemical Engineering	21	34	1	---	22	34
Chemistry	9	6	5	4	14	10
Civil Engineering	38	45	2	2	40	47
Crown & Bridge Prosthesis	---	1	---	---	---	1
Dentistry for Children	---	---	1	1	1	1
Economics	28	12	2	2	30	14
Education	7	9	4	8	11	17

TABLE II (Continued)

Field of Specialization	Men		Women		Total	
	Probationary	Non-probationary	Probationary	Non-probationary	Probationary	Non-probationary
Electrical Engineering	14	36	2	---	16	36
Engineering Mechanics	4	5	---	---	4	5
English	6	5	4	5	10	10
Forestry and Conservation	---	2	---	---	---	2
French	2	1	---	1	2	2
Geology	2	3	---	---	2	3
German	---	2	---	---	---	2
History	2	3	1	3	3	6
Internal Medicine	1	---	---	1	1	1
Journalism	---	1	---	---	---	1
Library Science	1	8	1	1	2	9
Linguistics	---	---	---	3	---	3
Mathematics	3	12	---	1	3	13
Mechanical Engineering	27	41	---	---	27	41
Music	---	---	1	---	1	---
Naval Architecture	3	4	---	---	3	4
Obstetrics and Gynecology	1	1	---	3	1	4
Ophthalmology	---	1	---	---	---	1
Oral Pathology and Periodontia	1	3	1	---	2	3
Oral Surgery	1	---	---	---	1	---
Orthodontics	---	4	2	---	2	4
Pharmaceutical Chemistry	---	1	2	---	2	1
Philosophy	---	---	---	1	---	1
Physics	9	4	1	---	10	4
Physiology	1	1	---	---	1	1
Political Science	11	2	3	2	14	4
Psychology	3	2	2	2	5	4
Russian	---	1	---	---	---	1
Sociology	1	---	3	1	4	1
Spanish	1	3	---	---	1	3

TABLE II (Continued)

Field of Specialization	Men		Women		Total	
	Probationary	Nonprobationary	Probationary	Nonprobationary	Probationary	Nonprobationary
Speech	---	1	---	3	---	4
Surgery	2	4	---	---	2	4
Zoology	3	9	1	1	4	10
Total	215	279	42	51	257	330

Tabulation

The IBM method (International Business Machines) was employed for the tabulation of the data. As usual, a code was designed which permitted the translation of the raw data to arbitrarily assigned numerical equivalents. The coded information was then punched on special cards. By properly "instructing" the machines, the desired information was obtained and subsequently subjected to statistical treatment.

Source of Data

Several sources were used to derive the data. The most important of these will be mentioned. The office of the University's International Center furnished the writer with the Directory of Foreign Students for the years 1947 to 1949, inclusive. These directories are compiled in the middle of each semester and contain the names of all foreign students and the school or college in which they are enrolled. From this source, the original list of 596 students mentioned above was drawn.

A second source of information was the office of the University Registrar. The writer was given permission to examine the scholastic records filed there for the 596 students with whom we are dealing.

A third source was the Bureau of Psychological Services, Examination and Evaluation Division. The Bureau had on file the scores on the Academic Aptitude Examination, Graduate Level and the Miller Analogies Test. This information was made available for our use.

A fourth source was the Records Office of the Graduate School. Here personal information about the students in the study was secured.

DESCRIPTION OF TESTS USED

A brief discussion of the psychological tests mentioned above follows. Additional references to these instruments, including experimental findings, will be found in Chapter II.

Miller Analogies Test.- According to its author, the Miller Analogies Test purports to assess the scholastic aptitude of graduate students. The first version of the test appeared in 1926 and it has been revised on many occasions. The particular test employed in this study, Form G, appeared in 1947.[1]

One hundred analogies comprise the test, which is practically self-administering and suitable for both individual

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[1] W. S. Miller, Manual for the Miller Analogies Test, Form G. New York: The Psychological Corporation, 1947, p. 3.

and group testing. There is a time limit of 50 minutes.
Miller has found that this time limit is ample for most
students. A correction in the score is made for students who
do not complete the test within that limit. The score is the
number right, the maximum possible score being 100.[1]

The validity of a test depends on the accuracy with
which the test measures what it purports to measure. Miller
reports that the coefficients of correlation obtained between
the Miller Analogies Test and grades in graduate studies are
sufficiently large to warrant the claim that the test is a
good predictive instrument. He goes on to say, however, that
"one must expect that the validity will vary from school to
school, from course to course, and from year to year."[2]

Guilford has this to say of the test:

The indications are that the Miller Analogies Test
is almost entirely a measure of the verbal comprehensive
factor. When we aim a test at predicting grade getting,
we are likely to come out with such a measure. Even at
the graduate level, courses emphasize concept formation
and the highly verbal student surpasses. The correla-
tions of the test with the Verbal Factor part of the
Graduate Record Examination clustered about .75 to .80.
Its correlation with a vocabulary test (reported by
R. R. G. Watt in a personal communication) was .86.[3]

As for the reliability of the test, Miller, using
three groups selected as representative of 770 graduate
students, found highly satisfactory reliability coefficients,

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[1]Ibid., p. 3.

[2]Ibid., p. 5.

[3]J. P. Guilford in The Fourth Mental Measurements
Yearbook, Oscar K. Buros (Editor). Highland Park, N. J.:
The Gryphon Press, 1953, p. 304.

.92 for two of the groups and .93 for the third. Apparently

one may have considerable confidence, therefore, in the

stability of individual scores.[1]

Norms are available based on graduate students enrolled

at forty universities. The groups vary in size according to

fields of study, ranging from 70 in Business Administration

to 1,084 in Psychology.[2]

Academic Aptitude Examination, Graduate Level.- This

test purports to assess the potentialities of the graduate

student at the University of Michigan. Travers and Wallace,

its authors, postulate that prediction on the graduate level

is based on the extent of mastery of the intellectual arts

and skills necessary for success in graduate work.[3]

Patterned somewhat after the American Council on Edu-

cation Psychological Examination, the test yields a verbal

ability score and a numerical ability score, abilities

hypothesized to be important in graduate success. The test

consists of multiple-choice items with five alternatives.

The authors describe the five parts of the test as follows:

> Part I. Vocabulary. Eighty words were selected from
> the technical terminology of the common areas of special-
> ization of graduate work including physical sciences,

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[1] Miller, op. cit., p. 4.

[2] Ibid., p. 9.

[3] Robert M. W. Travers and Wimburn L. Wallace, The
Assessment of the Academic Aptitude of the Graduate Student.
Ann Arbor: Bureau of Psychological Services, Examination and
Evaluation Division (mimeographed). Pp. 12.

biological sciences, social studies, languages, law, and philosophy.

Part II. Reading Comprehension. This test is called a reading test only from custom. It requires the student to reason rather than to memorize what has been read....

Part III. Verbal Reasoning. This test involves processes such as the identification of erroneous assumptions, inconsistencies, justifiable in contrast to unjustifiable conclusions, and the making of inferences which are probably but not necessarily correct.

Part IV. Quantitative Reasoning. This test involves reasoning with numbers, but does not involve mathematics much beyond that taught in junior high school. A few, but not many, of the problems place a considerable emphasis on the ability to understand descriptions of complex data.

Part V. Numerical Ingenuity. In this test the examinee is presented with a series of numerical problems each of which can be solved by a short method or a long method. The examinee is instructed to look for the short method of solving each problem. If he does not see the short method at once, he is to pass on to the next problem. This section of the test, unlike the other sections, emphasizes speed.[1]

The first three parts of the test yield the verbal factor score and the remaining two determine the numerical reasoning score. The coefficient of reliability for both the verbal and numerical scores was .86. For the total test (verbal and numerical scores combined) the reliability was .90.[2]

It should be stressed that the Academic Aptitude Examination, Graduate Level as a predictive instrument has been employed only at the University of Michigan. The test was validated on 484 students who were registered for six or

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[1]Ibid., p. 5.

[2]Ibid., p. 6.

more hours of graduate credit during each semester of the
academic year 1948-49. Foreign students were not included
in the validation procedure.

Travers and Wallace found coefficients of correlation
between total test scores and grades ranging from .10 in
Engineering to .50 for students in Languages and Literatures.
Unfortunately, norms are not available. This test will re-
ceive further mention in Chapter II.

DEFINITION OF TERMS

Four terms used throughout this study should be de-
fined. The terms and their meanings are set down below.

Probation refers to any student who earned a grade-
point ratio of less than 5.00 during any enrollment in the
Graduate School. It does not refer to disciplinary action
received for reasons other than academic deficiency.

Grade-point ratio refers to the student's average,
obtained by multiplying the number of credit hours of each
course by the numerical equivalent of the grade received,
adding all the honor points and dividing by the number of
hours attempted. The following grading scheme with letter
values is employed in the Graduate School: A+, 9; A, 8; A-,
7; B+, 6; B, 5; B-, 4; C+, 3; C, 2; C-, 1; D and E, 0.
Courses which were dropped or taken as a "Visitor" were not
included in computing the grade-point ratio.

Foreign student refers to any student who was born

outside the United States or its territorial possessions and who, furthermore, was not a naturalized citizen at the time of his first enrollment in the Graduate School.

Enrollment refers to either of the two semesters in the academic year or to a single summer session. The latter can be either of six or eight weeks' duration and, by and large, is equivalent to one-half of a regular semester.

SUMMARY

The nature of the problem has been discussed in this chapter. In Chapter II studies are reviewed which are pertinent to this investigation.

CHAPTER II

A BRIEF SURVEY OF RELATED STUDIES

Few studies are reported that pertain to foreign student achievement in the United States. Such as the writer has discovered, along with others which examine the psychological and social aspects of foreign student adjustment, are reviewed in the first part of this chapter.

The second part is devoted to a more general review of pertinent literature. Since, by and large, the number of predictive studies is legion, the writer has selected those which he felt would provide a background for the predictive variables employed in the present study.

Studies of the Achievement of Foreign Students

In 1953, the Committee on Problems of Foreign Students of the Association of Graduate Schools sponsored a study of foreign student achievement at member institutions. For that inquiry 25 graduate schools supplied information about 2,229 students.[1] Of this number, 85 per cent were men, 15 per cent women. These students represented 80 different countries, in numbers ranging from one to 309. China led with 309 students followed by Japan with 234; India, 201; England, 126; and Turkey, 75.

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[1]Association of Graduate Schools; Report of the Committee on Problems of Foreign Students. Ralph A. Sawyer, Chairman, et al., 1953 (mimeographed). Pp. 15.

Of the 2,229 students, 12 per cent were in the physical sciences; 17 per cent, in the biological sciences; 39 per cent, in the social sciences; 9 per cent, in language and literature; and 18 per cent, in engineering. For 5 per cent, the field was not specified. Women were found in greater proportions in the social sciences and in language and literature, where they constituted 21 and 27 per cent, respectively, but only 2 per cent of the engineering students were women.[1]

The study further shows that the better students came from the British Commonwealth and from Europe, while those from Latin-America experienced considerable academic difficulty, 35 per cent having "below average" records. Some relationship was found between country of origin and scholastic achievement in specific areas. For instance, Latin-American students had difficulty particularly in engineering and in the biological and social sciences, whereas the Near Eastern and Far Eastern students did best in engineering. When country of origin was disregarded, the academic performance of students in the physical sciences and engineering was superior to that of students in the biological sciences.[2]

At Ohio State University Thompson found that of 681 foreign students admitted to graduate work at that institution, 240 earned degrees, as follows: 30, the Bachelors; 148, the Masters; and 62, the Doctor of Philosophy. An additional 203 students were still in school at the time of the study. He considers this record of foreign students remarkable, despite the language handicap and cultural adjustments these students

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[1] Ibid., p. 1.

[2] Ibid., p. 8.

are required to make. Thompson points out that rigid require-
ments must be met before admission is granted - ten students
refused for every one admitted.[1]

Riley and Peterson made a study of seven institutions
in Southern California. Students from 34 countries were in-
cluded in their report. They found that academic customs and
traditions accounted for most of the difficulties experienced
by foreign students. Other difficulties reported were in-
ability to comprehend lectures, write reports, and the dis-
advantage of competing with American students for grades.[2]

Vaswani made a comprehensive study of the problems
confronting 599 foreign students enrolled at the Berkeley
Campus of the University of California. His sample consisted
of both graduate and undergraduate students. By means of a
specially designed questionnaire, he, too, found that foreign
students experienced difficulty in writing term papers and
taking lecture notes. Other problems mentioned were selection
of courses, family worries, lack of finances, finding housing,
too heavy a study load, and lack of participation in group
activities.[3]

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[1]Ronald B. Thompson, "Academic Records of Foreign
Students," College and University, XXVII (October, 1951), 31.

[2]Frank Riley and James A. Peterson, "Foreign Visitors
on American Campuses," Survey, LXXXV (August, 1949), 428.

[3]Hari V. Vaswani, A Study of the Problems of Foreign
Students at the Berkeley Campus of the University of California,
p. 146. Ed. D. dissertation, University of California at
Berkeley, 1950.

It is interesting to note differences in problems mentioned by students coming from different regions. Students from Asia (exclusive of India and China) mentioned a heavy study load, selection of courses, future plans, and financial difficulties. Finding housing and making plans for the future were mentioned most frequently by Indian students. Family worries constituted the major problem for the Chinese, followed by language difficulties, lack of finances, and lonesomeness. The significant problems for South American students were practical training, cost of living, and study load.[1]

Cieslak studied the administrative and guidance practices of 122 institutions of higher learning distributed among 41 states. He found that while admission practices varied, there was considerable agreement in the qualifications deemed desirable. In descending order of importance, the requirements most frequently mentioned were the following: (1) sufficient knowledge of English, (2) finances, (3) superior academic record, (4) a certificate equivalent to a high school diploma, (5) good health, and (6) character references.[2]

A special academic adviser was assigned the responsibility of approving the student's course of study in slightly more than a third of the institutions. But in most institutions guidance was given on the same basis as that for American

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[1] Ibid., p. 148.

[2] Edward C. Cieslak, A Study of Administrative and Guidance Practices for Students from Abroad in Representative Collegiate Institutions of the United States, p. 285. Wayne University, Ed. D. dissertation, 1953.

students. Despite this lack of preferential treatment for foreign students, Cieslak found that 84 per cent of the students were satisfied with the counseling and academic guidance they had received.[1]

Cieslak reported that the responses of 354 students to a question pertaining to their difficulties with the English language showed that Latin-American and Far Eastern students experienced more difficulty than Western European and Near Eastern students. The latter, coming from cultures resembling our own, assimilate more readily.[2]

Fisher,[3] Koenig,[4] and Southwick[5] have also emphasized the difficulty administrators face in selecting students from abroad. Transcripts are of little help since the scheme for marking varies from country to country and often within the same country. Moreover, there is no accredited list of foreign institutions, although the Institute of International Education and the United States Office of Education supply some

[1] Ibid., p. 294.

[2] Ibid., p. 287.

[3] Edgar G. Fisher, "Foreign Students on the Campus," Journal of the American Association of Collegiate Registrars, XXI (July, 1946), 545.

[4] Clara H. Koenig, "The Evaluation of Credentials from Foreign Countries," College and University, XXVII (October, 1951), 14.

[5] Arthur F. Southwick, "Evaluating Credentials of Foreign Students," Journal of the American Association of Collegiate Registrars, XXII (July, 1947), 534.

useful information. Koenig concluded that each applicant
should be dealt with individually and little attention paid
to precedent.[1]

The difficulty the foreign student faces in social
adjustment has been well stated by Gardner:

> The foreign student almost always experiences a
> diminished sense of personal worth.... He leaves behind
> his whole personal and social environment--his family,
> community and nation, the way of life and the sense of
> membership--the terms in which he is accustomed to
> identify himself and appraise his worth. He is intro-
> duced into a strange context in which his own status is
> ambiguous and difficult to establish. The position which
> he had at home means nothing here. In a sociological
> sense, he comes naked to our shores. Small wonder if he
> shivers a bit![2]

Other Predictive Studies

As mentioned above, the following studies are pre-
sented because they provide a background for many of the pre-
dictive variables employed in this project. In the interest
of brevity, the writer has made no attempt to analyze the
investigators' results. For a more detailed discussion of
academic prediction, the reader is referred to the extensive
reviews by Harris[3] and Garrett.[4]

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[1] Koenig, loc. cit.

[2] John W. Gardner, "The Foreign Student in America,"
Foreign Affairs, XXX (July, 1952), 642.

[3] Daniel Harris, "Factors Affecting College Grades: A
Review of the Literature, 1930-1937," Psychological Bulletin,
XXXVII (March, 1940), 125-166.

[4] Harley F. Garrett, A Review and Interpretation of
Investigations of Factors Related to Scholastic Success in
Colleges of Arts and Sciences and Teachers Colleges. An un-
published doctoral dissertation, University of Colorado, 1948.
Pp. 455.

<u>Sex</u> <u>and</u> <u>Achievement</u>.- Numerous investigators have studied the relation of sex to grades at the college level. Byrns,[1] Eells,[2] Farber and Riggs,[3] and Gowen and Gooch[4] reported a significantly higher achievement by women. DeRidder[5] found women incurred probation far less frequently than men, and McNeely[6] and Snyder[7] reported that proportionately more women than men continued in college until graduation.

Munger,[8] in a recent study of students who were admitted to college from the lower third of their respective

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[1]Ruth K. Byrns, "Scholastic Aptitude and Freshman Achievement," <u>School</u> <u>and</u> <u>Society</u>, XXXV (May 21, 1932), 713.

[2]Walter C. Eells, "Records of Junior-College Transfers in the University," <u>School</u> <u>Review</u>, XXXVII (March, 1929), 187.

[3]Robert H. Farber and Lawrence Riggs, "Veterans in a Privately Endowed Liberal Arts College, 1946-1950," <u>School</u> <u>and</u> <u>Society</u>, LXXII (August 12, 1950), 105-106.

[4]John W. Gowen and Marjorie Gooch, "Age, Sex and the Interrelations of Mental Attainments of College Students," <u>Journal</u> <u>of</u> <u>Educational</u> <u>Psychology</u>, XVII (March, 1926), 198.

[5]Lawrence M. DeRidder, <u>Selected</u> <u>Factors</u> <u>Related</u> <u>to</u> <u>the</u> <u>Academic</u> <u>Achievement</u> <u>of</u> <u>Probationary</u> <u>Students</u> <u>Graduated</u> <u>in</u> <u>1948</u> <u>from</u> <u>the</u> <u>College</u> <u>of</u> <u>Literature</u>, <u>Science</u>, <u>and</u> <u>the</u> <u>Arts</u> <u>of</u> <u>the</u> <u>University</u> <u>of</u> <u>Michigan</u>, p. 111. An unpublished doctoral dissertation, University of Michigan, 1950.

[6]John H. McNeely, <u>College</u> <u>Student</u> <u>Mortality</u>, p. 45. U. S. Office of Education Bulletin, 1938, No. 11. Washington: Government Printing Office, 1938.

[7]Louise M. Snyder, "Why Do They Leave?" <u>Journal</u> <u>of</u> <u>Higher</u> <u>Education</u>, XI (January, 1940), 27.

[8]Paul F. Munger, <u>Factors</u> <u>Related</u> <u>to</u> <u>Persistence</u> <u>in</u> <u>College</u> <u>of</u> <u>Students</u> <u>Who</u> <u>Were</u> <u>Admitted</u> <u>to</u> <u>the</u> <u>University</u> <u>of</u> <u>Toledo</u> <u>from</u> <u>the</u> <u>Lower</u> <u>Third</u> <u>of</u> <u>Their</u> <u>Respective</u> <u>High</u> <u>School</u> <u>Classes</u>, p. 136. An unpublished doctoral dissertation, University of Michigan, 1954.

high school classes, reported no significant differences between the sexes in persistence in college or in the completion of the requirements for a college degree.

At the graduate level, Peterson[1] found a sex difference in achievement in favor of women, but the difference was not statistically significant. Harris,[2] in a comprehensive review of the literature, has concluded that the evidence is preponderantly in favor of women as the "better achievers."

Age at Admission and Achievement.- Age is another factor that has been frequently correlated with grades. The findings, however, are contradictory. Carter and McGinnis,[3] Ferguson,[4] Odell,[5] and Pierson[6] indicated that the younger students did better work.

Other investigators have not found a superiority in

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[1]Stuart C. Peterson, The Measurement and Prediction of Scholastic Achievement on the Graduate Level, p. 25. An unpublished doctoral dissertation, State University of Iowa, 1943.

[2]Harris, op. cit., p. 128.

[3]Homer L. Carter and Dorothy J. McGinnis, "Some Factors Which Differentiate College Freshmen Having Lowest and Highest Point-Hour Ratios," Journal of Educational Research, XLVI (November, 1952), 221.

[4]George O. Ferguson, "Some Factors in Predicting College Success," School and Society, XXXVII (April 29, 1933), 567.

[5]Charles W. Odell, "The Effect of Early Entrance upon College Success," Journal of Educational Research, XXVI (March, 1933), 511.

[6]Roland R. Pierson, "Age Versus Academic Success in College Students," School and Society, LXVIII (August 7, 1948), 94.

achievement by the younger student. Crawford,[1] DeRidder,[2] Gowen and Gooch,[3] and Munger[4] reported that grades and chronological age were not closely related.

Peterson's[5] study of the relation of age to achievement in graduate school indicated that while obtained differences favored the younger students, few of these differences were statistically significant.

Dwyer,[6] who surveyed the literature in this area, concluded that correlations between age and achievement were too low to be valuable for individual prediction.

Employment Status and Achievement.- As in the case of age, the findings in regard to the effect of outside employment upon achievement are largely contradictory. Uhrbrock[7] reported that the average low-scholarship student spent 10.51 hours at remunerative tasks, whereas the average high-scholarship student devoted 6.48 hours to outside employment.

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[1]Albert B. Crawford, "Forecasting Freshman Achievement," School and Society, XXXI (January, 1930), 129.

[2]DeRidder, op. cit., p. 86.

[3]Gowen and Gooch, op. cit., p. 196.

[4]Munger, op. cit., p. 67.

[5]Peterson, op. cit., p. 20.

[6]Paul S. Dwyer, "The Correlation between Age at Entrance and Success in College," Journal of Educational Psychology, XXX (April, 1939), 262.

[7]Richard S. Uhrbrock, "The Freshman's Use of Time," Journal of Higher Education, II (March, 1931), 142.

Shaffner's[1] findings showed that employment had a positive relation to achievement. She reported that the students employed six to twenty-one hours per week ranked highest and the non-workers ranked lowest. Touton,[2] and Wagner, Eiduson, and Morris[3] likewise found that outside work tended to be associated with higher grades.

Cash,[4] in a study of theological students, reported that there was no predictive relationship between employment and academic success.

Garrett,[5] who studied the findings in this area, concluded that additional research was needed to arrive at a more satisfactory understanding of the role of employment in academic success.

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[1] Martha Shaffner, "The Effect of Part-Time Employment on the Scholarship Ratings of College Students," School and Society, L (October, 1939), 542.

[2] Frank C. Touton, "Scholastic Aptitudes and Achievements of FERA Students," School and Society, XLII (August 24, 1935), 270.

[3] Mazie E. Wagner, H. P. Eiduson, and R. J. R. Morris, "The Effect of FERA Employment upon College Grades," School and Society, XLV (January 2, 1937), 26.

[4] William L. Cash, Relation of Personality Traits to Scholastic Aptitude and Academic Achievement of Students in a Liberal Protestant Seminary, p. 97. An unpublished doctoral dissertation, University of Michigan, 1954.

[5] Harley F. Garrett, "A Review and Interpretation of Investigations of Factors Related to Scholastic Success in Colleges of Arts and Science and Teachers Colleges," Journal of Experimental Education, XVIII (December, 1949), 120.

<u>Admission With or Without Financial Aid</u>.- Zeigel[1]
studied the administration of scholarships at the University
of Missouri. He compared the achievement of a group who
were honor students in high school with a group of students
who were other than honor students. The high school honor
students earned better grades in college, belonged to more
honorary fraternities, and participated in more extra-
curricular activities. Zeigel concluded that the University
of Missouri was justified in awarding scholarships on the
basis of high school grades.

Moon[2] and Bildersee[3] reported that college freshmen
holding scholarships not only received higher grades and more
scholastic honors, but also participated more frequently in
extra-curricular activities than did a group of unselected
students.

At the graduate level, Smith[4] found that the scholastic

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[1]William H. Zeigel, "Achievement of High-School Honor
Students in the University of Missouri," <u>School and Society</u>,
XXV (January 15, 1927), 82-84.

[2]George R. Moon, "Records of Students Who Entered
University with Freshman Scholarships," <u>School Review</u>
XXXVIII (June, 1930), 449.

[3]Adele Bildersee, <u>State Scholarship Students at Hunter
College of the City of New York</u>, p. 119. New York: Columbia
University, Teachers College Contributions to Education, No.
540, 1932.

[4]Margaret R. Smith, <u>Student Aid: Bases of Selection
of Students to Whom Loans, Scholarships, and Fellowships Are
Awarded in a Graduate School of Education</u>, p. 57. New York:
Columbia University, Teachers College Contributions to Edu-
cation, No. 704, 1937.

achievement of students who were awarded scholarships was significantly superior to that of a control group that represented a sampling of non-scholarship students at that institution.

Crawford,[1] in a comprehensive study of the relation of financial aid to achievement, concluded that the higher grades of scholarship holders may be attributed to the increased motivation of the recipients.

Field of Concentration and Achievement.- A few investigators have indicated that the field of concentration has no bearing on academic success. Fritz[2] reported that he found no relation between curriculum and grades. His findings are supported by Heaton and Weedon,[3] who concluded that the departmental major had no effect on failure.

Remmers,[4] however, reported that the better students are to be found in the fields of agriculture, chemical engineering, and in the sciences. Siemens'[5] study supported these findings. He stated that students majoring in the more

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[1]Albert B. Crawford, Incentives to Study, p. 76. New Haven: Yale University Press, 1929.

[2]Ralph A. Fritz, "Predicting College Marks and Teaching Success for Students in a Teachers College," Journal of Applied Psychology, XVII (1933), 439-446.

[3]Kenneth L. Heaton and Vivian Weedon, The Failing Student, p. 29. Chicago: The University of Chicago Press, 1939.

[4]H. H. Remmers, "Some Attributes of Superior Students," Personnel Journal, X (1931), 177.

[5]Cornelius H. Siemens, "Predicting Success of Transfer Students," Junior College Journal, XIV (September, 1943), 24.

technical and specialized fields were found to have a higher
mentality. DeRidder,[1] in an extensive study of students who
had incurred probation, reported that these students con-
centrated most frequently in the social studies.

McConnell and Eckert,[2] Morton and Miller,[3] and Read[4]
ranked several fields of specialization on the basis of the
grades earned by students in each field. These investigators
were in general agreement that majors in modern and classical
languages were usually in the top fifth in scholastic ranking,
that majors in aeronautical engineering and chemistry were in
the middle group, and that majors in business administration,
economics, and physical education were lowest.

Additional evidence that students experience more
difficulty in certain subjects is cited by Eurich.[5] He
pointed out that the two courses Arts college students found
most difficult at the University of Minnesota were physics
and French.

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[1]DeRidder, op. cit., p. 75.

[2]T. R. McConnell and Ruth E. Eckert, "Undergraduate
Programs of Students Receiving the B.A. Degree," Biennial Re-
port of the Committee on Educational Research: Studies in
Higher Education, p. 125. Minneapolis: University of
Minnesota Press, 1943.

[3]R. L. Morton and Leslie H. Miller, "A Comparative
Study of the Scholarship Records of Students Who Major in
Mathematics," School Science and Mathematics, XXXVI (December,
1936), 966.

[4]Cecil B. Read, "Comparative Records of Departmental
Majors," School and Society, XLVII (January 22, 1938), 127.

[5]Alvin C. Eurich, "College Failures," School and
Society, XXXVIII (May 27, 1933), 696.

Jenson[1] and Peterson,[2] in their studies of academic
achievement at the graduate level, reported that the English
majors ranked highest; education, mathematics, and psychology
majors were in the middle group; and chemistry majors ranked
lowest.

Zagorski[3] obtained similar findings in a study of 602
graduate students enrolled in seven fields. The grade-point
averages in the fields of specialization studied were as
follows (B = 2.00): English, 2.50; history, 2.46; psychology,
2.30; retail training and secondary education, 2.21; chemical
engineering, 2.10; and chemistry, 1.87.

The preponderance of evidence seems to warrant the
conclusion that the field of concentration is related to
achievement at both the undergraduate and graduate levels.

Student Load and Achievement.- Lehman and Stoke[4]
studied the effects of an increased and a decreased course
load in a given semester upon subsequent achievement at Ohio
University. They found that the grades earned by students
who registered for the greater number of courses surpassed

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[1]Ralph N. Jenson, Predicting Scholastic Achievement
of First-Year Graduate Students, p. 33. An unpublished
doctoral dissertation, University of Pittsburgh, 1949.

[2]Peterson, op. cit., p. 51.

[3]Henry J. Zagorski, A Pattern Analysis of the Miller
Analogies Test, p. 12. An unpublished master's thesis,
University of Pittsburgh, 1949.

[4]Harvey C. Lehman and Stuart M. Stoke, "Is the Heavy
Schedule an Incentive to Greater Effort?" School and Society,
XXXII (December 6, 1930), 769.

the grades received by students who attempted fewer courses.

Holtz and Trice,[1] however, arrived at a different conclusion. They reported that students who had either increased or decreased the amount of work pursued in a given semester showed a greater gain in grade-point average when compared with students who maintained the same course load. It is interesting to note, moreover, that the greater increase in grade-point average was attributed to those students who had decreased their course load.

Somewhat similar findings are reported by Neel and Mathews.[2] They found, when intelligence was controlled, that the better students attempted fewer courses. McGrath and Froman,[3] in a study of students enrolled in an evening session, likewise reported an inverse relationship between grades and number of courses attempted.

Studies at the graduate level in this area of prediction are limited. Jenson[4] and Zagorski[5] reported a positive relationship between the grades of first-year graduate

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[1]H. G. Holtz and J. A. Trice, "The Relation of an Abnormal Weekly Schedule to Grade-Point Average," School and Society, XXXIX (March 31, 1934), 424.

[2]Mary O. Neel and C. O. Mathews, "Needs of Superior Students," Journal of Higher Education, VI (January, 1935), 30.

[3]Earl J. McGrath and Lewis A. Froman, "College Aptitude of Adult Students," University of Buffalo Studies, XIV (November, 1936), 19.

[4]Jenson, op. cit., p. 30.

[5]Zagorski, op. cit., p. 12.

students at the University of Pittsburgh and the number of credits earned. English majors, who ranked highest in grade-point average, earned an average of 24.1 credits, whereas chemistry majors, who ranked lowest, earned an average of 15.6 credits.[1]

Miller Analogies Test Scores and Achievement.- Several studies are reported on the effectiveness of the Miller Analogies Test in predicting grades at the graduate level. Verplanck,[2] in a study of 44 graduate students at Indiana, found a product-moment correlation of .36 with grade-point average in chemistry.

Zagorski[3] studied the relationship between the scores on the Miller Analogies and the academic performance of 602 graduate students at the University of Pittsburgh who were enrolled in seven fields, as follows: chemistry, chemical engineering, English, history, psychology, retail training, and secondary education. The highest coefficients of correlation were obtained for students in secondary education and retail training, .51 and .45, respectively. The lowest correlations reported were for students in English and chemistry, .29 and .21, respectively.

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[1]Ibid., p. 12.

[2]W. S. Verplanck, "Supplementary Validity Data," Miller Analogies Test Bulletin, No. 2. New York: Psychological Corporation, 1948.

[3]Zagorski, op. cit., p. 36.

Jenson,[1] in a study of 335 graduate students at the same institution, reported considerably lower correlations. The highest correlation, .36, was reported for students enrolled in education and psychology. The lowest correlations were reported for students enrolled in chemistry and English, .32 and .26, respectively.

McNemar[2] correlated total test scores with grades in several psychology courses. He reported correlations ranging from .54 in advanced statistics to .01 in history. McNemar concluded that the Miller Analogies Test would predict best those courses which require reasoning, and to a lesser extent those requiring memory.

Kelly and Fiske[3] studied the relationship between scores on this test and the training record of 471 students in clinical psychology. They reported a highly significant difference between the mean Miller score for those who successfully completed their training for the Ph.D. degree and the mean score for students who were dismissed from the program. Another interesting finding was that Miller scores correlated .45 with scores on each of two achievement tests administered to the students. These investigators concluded

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[1] Jenson, op. cit., pp. 51-70.

[2] Quinn McNemar, "Supplementary Validity Data," Miller Analogies Test Bulletin, No. 2. New York: Psychological Corporation, 1948.

[3] E. Lowell Kelly and Donald W. Fiske, "The Prediction of Success in the VA Training Program in Clinical Psychology," American Psychologist, V (August, 1950), 402.

that the Miller Analogies Test "... may be of considerable value to the universities in selecting applicants who can meet the academic demands of the training program."[1]

Doppelt[2] classified the subject matter of the Miller Analogies into science and non-science categories. The classification of the item was found not to be as important as the major field of the student. Psychology majors excelled on both the science and non-science items, followed by other science majors. "Non-science" majors (social studies, languages, arts, etc.) were considerably inferior to all others on both science and non-science items. This investigator noted that the higher standards for admission established by graduate departments of psychology might account for the better performance of psychology majors.

The evidence concerning the ability of the Miller Analogies Test to predict achievement for graduate students in education is largely contradictory. Cook[3] reported a mean correlation coefficient of .48 between test scores and grades in several education courses at the University of Minnesota. He concluded that the test was sufficiently indicative of success in graduate education courses to be retained as a

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[1] Ibid., p. 404.

[2] Jerome E. Doppelt, "Difficulty and Validity of Analogies Items in Relation to Major Field of Study," Journal of Applied Psychology, XXXV (February, 1951), 32.

[3] Walter W. Cook, "Predicting Success of Graduate Students in a College of Education," School and Society, LVI (September 5, 1942), 195.

measure of general aptitude.

Travers and Wallace,[1] however, arrived at a different conclusion. These investigators administered the Miller Analogies Test to 484 graduate students at the University of Michigan. They reported that the test scores correlated quite low with grades in education, namely .22. They reported additional correlations between test scores and major fields of study as follows: engineering, .09; languages and literature, .34; physical sciences, .38; and social studies, .18. These low correlations were in part attributed to the instability of students' average grades from one semester to the next.

Academic Aptitude Examination, Graduate Level and Achievement.- It was pointed out in the previous chapter that the Academic Aptitude Examination, Graduate Level as a predictive instrument has been employed only at the University of Michigan. Travers and Wallace[2] found that the verbal score of the test had the highest correlations with grades in education, languages and literature, and in the social studies. The numerical score on the test, however, had the greater predictive value for the students majoring in engineering and in the physical sciences.

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[1] Robert M. W. Travers and Wimburn L. Wallace, "The Assessment of the Academic Aptitude of the Graduate Student," Educational and Psychological Measurement, X, No. 3 (Autumn, 1950), 377.

[2] Ibid., p. 376.

These findings are explained in part by the pertinent observation that students in languages and the social sciences are commonly tested upon their memory of facts, whereas students in the physical sciences and in engineering are called upon for problem solving and reasoning abilities.

Lest the reader be misled by the foregoing account, it should be pointed out that both part scores, individually, and total scores on the test had low correlations with grades in several fields of study. For example, the correlations of total test scores with achievement in certain broad areas of study were as follows: education, .47; engineering, .10; languages and literature, .50; physical sciences, .27; and social sciences, .31.

In reviewing their findings, Travers and Wallace[1] concluded that the Academic Aptitude Examination, Graduate Level did not have a sufficiently high predictive value to warrant its continued use as a measure of a student's aptitude for graduate work. This test is not currently administered to graduate students at the University of Michigan.

SUMMARY

In this chapter, a review of the literature pertinent to this project has been presented. In the following chapter, the statistical procedure employed in this study is presented.

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[1]_Ibid._, p. 377.

CHAPTER III

STATISTICAL PROCEDURES EMPLOYED

It will be recalled that the major purpose of this study was to discover factors associated with the academic achievement of foreign graduate students. As noted earlier, the experimental group consisted of 257 students who incurred probation at some time during their residence in the Horace H. Rackham School of Graduate Studies. The control group consisted of 330 students in residence during the same period who did not incur probation. The present chapter discusses the statistical techniques employed in order to determine the presence of any significant differences in the characteristics of the two groups.

The chi-square, the Fisher-t, and the analysis of variance comprise the principal statistical techniques used in this project. The proper application of these techniques enables us to determine whether the probationary and non-probationary groups differ with respect to a given trait under consideration.

Edwards[1] and McNemar[2] have pointed out that these

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[1]Allen L. Edwards, Statistical Analysis for Students in Psychology and Education, p. 133. New York: Rinehart and Company, Inc., 1946.

[2]Quinn McNemar, "Sampling in Psychological Research," Psychological Bulletin, XXXVII (June, 1940), 336.

tests of significance must be applied to a null hypothesis which we are interested in rejecting. The null hypothesis states that there is no difference between the two populations or universe measures sampled. The null hypothesis, as applied in the subsequent analysis of our data, could be stated as follows: In the population of which these cases may be considered a random sample, probationary students and non-probationary students do not differ with respect to the trait under consideration. This would mean that the two groups have been drawn from the same or identical population and are therefore essentially alike in the trait measured.

In order for the null hypothesis to be rejected at a high level of confidence, the difference obtained between our samples must be too large to be reasonably attributed to chance. Such a difference is commonly referred to as "statistically significant." In this study when it is stated that a difference is statistically significant reference is made to the 5 per cent level of confidence. This means that chance fluctuations as great as, or greater than, the one reported could occur in less than 5 per cent of similar samples if the true difference were zero. Stated somewhat differently, we are highly confident that the two populations differ in the trait measured.

The foregoing presents the general procedures employed in analyzing our data. We may now consider the statistical formulae used for computing the chi-square, the Fisher-t, and the analysis of variance.

CHI-SQUARE TEST

The chi-square test was used as a means of testing the agreement between observation and hypothesis in those instances where non-continuous data could be classified into mutually exclusive categories. If the observed frequencies should agree completely with the hypothetical, chi-square would be zero and we would be justified to assume that the two groups arose by random sampling from the same population. As the observed frequencies depart more and more from the frequencies which we would expect from a chance distribution, the value of chi-square increases. The usual formula for computing chi-square is:[1]

$$x^2 = \sum\left[\frac{(f_o - f_e)^2}{f_e}\right] \qquad (1)$$

where f_o represents the observed frequency, f_e the expected frequency, and $\sum$ the symbol for summation.

The chi-square for a fourfold table (2 x 2 classification) can be computed by a simpler formula:[2]

$$x^2 = \frac{(ad - bc)^2 N}{(a + b)(c + d)(a + c)(b + d)} \qquad (2)$$

where a, b, c, and d denote the observed frequencies in the four cells, and a + b, c + d, a + c, and b + d represent the

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[1]J. P. Guilford, Fundamental Statistics in Psychology and Education, p. 276. New York: McGraw-Hill Book Company, Inc., 1950.

[2]Helen M. Walker and Joseph Lev, Statistical Inference, p. 101. New York: Henry Holt and Company, 1953.

marginal frequencies. The symbol N represents the total number of cases observed.

An alternative formula likewise enables us more readily to compute the chi-square for a 2 x n classification. Fisher[1] recommends the use of the following formula:

$$x^2 = \frac{1}{\bar{p} \; \bar{q}} \left(\sum a_1 p - N_1 \bar{p} \right) \qquad (3)$$

in which, for a given row

a_1 = number in the first column for a given row

p = proportion of row total found in that column

N_1 = total observed frequency in the first column

$\bar{p}$ = proportion of the total observed frequency occurring in that column

$\bar{q}$ = 1 - $\bar{p}$

It was important to determine whether the chi-square obtained by using the above formulae was significant at the desired level of confidence. A table of chi-squares was consulted for this purpose.[2] This table indicates the chi-square which must be obtained for the observed difference to be significant for any specified number of degrees of freedom. The degrees of freedom in a chi-square contingency table can be easily computed by the following formula:[3]

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[1]R. A. Fisher, Statistical Methods for Research Workers, p. 87. Edinburgh: Oliver and Boyd, Ltd., 1946.

[2]Ibid., p. 113.

[3]Guilford, op. cit., p. 277.

$$df = (r - 1)(k - 1) \tag{4}$$

where r equals the number of rows and k equals the number of columns.

FISHER-t TEST

The Fisher-t statistic was used in those instances where the data were continuous in nature. The symbol t represents a ratio between any statistic normally distributed and its estimated standard error. It may be used to determine whether any observed difference in the means of two samples is significant or merely due to accidents in sampling. The Fisher-t formula for testing the difference of two uncorrelated means is:[1]

$$t = \frac{M_1 - M_2}{\sqrt{\left[\dfrac{\Sigma x^2_1 + \Sigma x^2_2}{N_1 + N_2 - 2}\right] \cdot \left[\dfrac{N_1 + N_2}{N_1 \cdot N_2}\right]}} \tag{5}$$

where

M_1 = mean in the first sample

M_2 = mean in the second sample

Σx^2_1 = sum of squares in the first sample

Σx^2_2 = sum of squares in the second sample

N_1 = number of cases in the first sample

N_2 = number of cases in the second sample

A derived Fisher-t formula was used for analyzing

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[1] Ibid., p. 228.

the various data:

$$t = \frac{N_1 \Sigma X_2 - N_2 \Sigma X_1}{\sqrt{(N_1 L_{22} + N_2 L_{11})\left(\frac{(N_1 + N_2)}{(N_1 + N_2 - 2)}\right)}} \tag{6}$$

in which

N_1 = number of cases in the first group

N_2 = number of cases in the second group

ΣX_1 = sum of observed values in the first group

ΣX_2 = sum of observed values in the second group

$L_{11} = N_1 \Sigma X^2_1 - (\Sigma X_1)^2$

$L_{22} = N_2 \Sigma X^2_2 - (\Sigma X_2)^2$

The formula for computing the degrees of freedom is:

$$df = N_1 + N_2 - 2 \tag{7}$$

We have indicated above that the $\underline{t}$ ratio may be used for testing the divergence of the obtained results from the results which we would expect on the hypothesis that no difference exists. The level of significance of the obtained differences was determined by referring to a probability table of $\underline{t}$. Only in those instances where $\underline{t}$ was found to be as large or larger than the value tabulated as significant at the 5 per cent level was the null hypothesis of no difference rejected. The obtained divergence from zero would be exceeded by chance in less than 5 per cent of similar random samples if the null hypothesis were true.

ANALYSIS OF VARIANCE TEST

The analysis of variance technique was employed in those instances where differences among a set of several means were to be evaluated. A unique characteristic of this method is that it permits us to test the differences between all of the group means simultaneously. It is in this respect that the analysis of variance technique differs most from the Fisher-t test described above. The latter procedure is applicable for determining the significance of the difference between two means.

A null hypothesis was set up to the effect that the several sets of data were sufficiently homogeneous to be considered as belonging to the same population. Only if the hypothesis could be rejected at the 5 per cent level did we feel justified to conclude that some real differences existed among the various groups tested. In those instances, the probability was high that the differences obtained between the several means of the various groups could not be attributed to accidents in sampling. In fact, only in five out of 100 trials could such differences be explained in terms of fluctuations in random sampling.

Lindquist[1] has stated the logic underlying this procedure rather succinctly:

The basic proposition is that from any set of r groups of n cases each, we may, on the hypothesis that

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[1] E. F. Lindquist, *Statistical Analysis in Educational Research*, p. 91. Boston: Houghton Mifflin Company, 1940.

all groups are random samples from the same populations,
derive two independent estimates of the population
variance, one of which is based on the variance of group
means, the other on the average variance within groups.
The test of this hypothesis then consists of determining
whether or not the ratio (F) between these estimates lies
below the value in the table for F that corresponds to
the selected level of significance.

Edwards[1] has suggested the following general formula
for obtaining the variance estimate of means in large or small
samples of unequal size:

$$\sum x^2 - \frac{(\sum x)^2}{N} = \left[\sum x_1^2 - \frac{(\sum x_1)^2}{n_1} + \sum x_2^2 - \frac{(\sum x_2)^2}{n_2} + \ldots \right.$$

$$\left. + \sum x_r^2 - \frac{(\sum x_r)^2}{n_r} \right] + \left[\frac{(\sum x_1)^2}{n_1} + \frac{(\sum x_2)^2}{n_2} + \ldots + \frac{(\sum x_r)^2}{n_r} - \right. \tag{8}$$

$$\left. \frac{(\sum x)^2}{N} \right]$$

in which

$\sum$ = summation

$\sum x_i$ = sum of the scores in a given group

$\sum x_i^2$ = sum of the squares of scores in a given group

n_i = number of cases within each group

N = total number of individuals

$\sum X$ = sum of the scores for all groups

$\sum X^2$ = sum of the squares of the scores for all groups

It should be noted from the above formula that the
total sum of the squares is equal to the sum of the squares
between groups plus the sum of the squares within groups.

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[1]Edwards, op. cit., pp. 202-207.

An alternative formula which facilitated the computations involved was used in the present study.

$$\sum_i \sum_j x^2_{ij} - \overline{X}T = \sum_i \left[\sum_j x^2_{ij} - \overline{X}_i T_i \right] + \sum_i T_i \overline{X}_i - \overline{X}T \quad (9)$$

(Total)   (Within)   (Between)

in which

$\sum_i$ = sum for all groups

$\sum_j$ = sum over individuals within a group

T_i = sum for a given group

$\overline{X}_i$ = mean for a given group

$\overline{X}$ = mean for the total

$\sum$ = summation

The degrees of freedom may be computed as follows:[1]

$$df = r - 1 \quad \text{(Between groups)}$$
$$= r (n - 1) \quad \text{(Within groups)} \quad (10)$$
$$= rn - 1 \quad \text{(Total)}$$

in which r is the number of groups and n represents the number of cases within each group.

In those instances where $\underline{F}$ was significant at the 5 per cent or 1 per cent levels of confidence, the $\underline{t}$ test previously described was employed to determine where the significance in the data existed. The rationale underlying this procedure can be readily explained. It is highly improbable that all of the means are significantly different from all other means. "Even when $\underline{F}$ is significant at the 1

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[1]Walker and Lev, op. cit., p. 226.

per cent level, if one mean stands out as very different from the rest and the others differ very little, it is not likely that all mutual differences are significant."[1] The _t_ test, as noted earlier, is well adapted to indicate which differences between any two means are statistically significant.

Prior to using the _F_ test described above, it was necessary to ascertain whether the samples were random samples from populations with a common variance. Bartlett's test for homogeneity of variance was employed for this purpose. Ordinarily, when the value of _F_ leads us to reject the null hypothesis, the populations from which the samples have been drawn may differ in terms of either means or variances or both.[2] If, by applying Bartlett's test, we determine that the variances are the same, we can infer that it is the means which differ.

Bartlett's formula for ascertaining the homogeneity of variance may be expressed as follows:[3]

$$M = - \Sigma_{nk} \log (S_k / n_k) + n \log (S / n)$$

$$\text{and} \qquad c = 1 + \frac{1}{3(b-1)} \left[\Sigma \left(\frac{1}{n_k} \right) - \frac{1}{n} \right]$$

(11)

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[1]Guilford, op. cit., p. 241.

[2]Edwards, op. cit., p. 193.

[3]J. F. Kenney and E. S. Keeping, Mathematics of Statistics, Part Two, pp. 255-256. New York: D. Van Nostrand Company, Inc.

where $\quad \Sigma$ = summation

$$S_k = \Sigma_j (x_{jk} - \overline{X}_k)$$

j = number of cases in each sample

k = number of samples

x_{jk} = scores for each individual sample

$\overline{X}_k$ = mean for a sample

$n_k = N_k - 1$ where N_k is the total number of
observations in the sample

$S = \Sigma_k S_k$

$n = \Sigma n_k$

c = constant

and M/c is distributed approximately as a chi-square having
b - 1 degrees of freedom, where b represents the number of
samples.

SUMMARY

In this chapter we have discussed the principal
statistical techniques employed in the analysis of our data.
We were essentially concerned with the problem of how the
significance of any obtained differences in our subsequent
analysis of the data could be ascertained. It was noted that
the chi-square, the Fisher-t, and the analysis of variance
were the tests of significance used. The conditions which
warranted the use of one statistic in preference to another
were also noted. Finally, the formulae used were presented
along with an explanation of each.

In the following chapter we shall see the application
of these techniques in the analysis and interpretation of our
data.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

The statistical procedures described in the previous chapter were used to analyze the predictive variables enumerated in Chapter I in order to discover the existence of any significant differences between probationary and non-probationary foreign graduate students. Each of these variables selected for study will be treated in the order in which they were presented in Chapter I.

The Relation of Personal Factors to Achievement

Do probationary and non-probationary foreign graduate students differ significantly in their biographical data? In Chapter II we noted that the literature in the area of prediction did not supply us with an answer to this question. The various personal factors employed in this project are analyzed below in order to arrive at a partial answer.

Sex and Achievement.- To what extent, if any, is sex related to academic achievement?

Table III tests the hypothesis that the achievement of men and women is equal. The chi-square test was applied to determine whether the sex ratio in the probationary group was significantly different from that found in the original group. The chi-square value of .03 is insignificant at both the 5 per cent and 1 per cent levels of confidence and would

TABLE III

CHI-SQUARE ANALYSIS OF THE RELATION OF SEX TO ACADEMIC ACHIEVEMENT

Grouping	Probationary	Non-probationary	Total	x^2
Men	215	279	494	
Women	42	51	93	.03
Total	257	330	587	

Chi-square is not significant.

indicate that any differences as between men and women can be attributed to accidents of sampling. For instance, it may be noted that of the probationary group, 215 or 84 per cent were men. This sex ratio is also characteristic of the entire population, since 494 or 84 per cent were men.

The obvious conclusion is that the probationary group was distributed rather evenly between the sexes. We are therefore justified to accept the hypothesis that the achievement of men and women is equal.

It is interesting to note in passing that men constituted a large majority of the foreign student population. There were slightly more than five men for every woman enrolled in the Horace H. Rackham School of Graduate Studies. Since sex was not significantly related to achievement, the evidence did not argue for separate treatment of men and women in the subsequent analysis of the various data.

Entering Age and Achievement.- Is age upon admission significantly related to achievement?

The Fisher-t test was employed to determine whether probationary students could be distinguished from non-probationary students upon the basis of entering age. Table IV shows a difference of .18 year was obtained between the mean entering ages of the two groups, the non-probationary students having the higher mean.

TABLE IV

SIGNIFICANCE OF DIFFERENCE OF MEAN ADMISSION AGES OF
PROBATIONARY AND NON-PROBATIONARY STUDENTS

Entering Age	Probationary	Non-probationary
20	3	4
21	6	8
22	15	23
23	25	30
24	32	25
25	26	34
26	34	43
27	17	26
28	24	34
29	12	20
30	15	16
31	10	7
32	7	9
33	3	14
34	5	12
35	7	10
36	5	6
37	5	2
38	2	2
39	1	1
40	0	2
41	1	0
42	1	2
44	1	0
Mean	27.15	27.33
t	.51[*]	

[*] Not significant.

The ratio of significance, however, does not permit us to view the results as representing a true difference. There are considerably more than five chances in 100 that a difference as large as this one, or larger, would occur by random sampling of the original group. Stated somewhat differently, the observed difference is lacking in statistical significance and we are justified in retaining the null hypothesis. It may be concluded that age upon admission is not significantly related to achievement.

Marital Status and Achievement.- Is there any relationship between the marital status of students and their academic achievement?

Table V employs the chi-square test to determine the association between marital status and achievement. A null hypothesis was set up to the effect that there are no significant differences in the achievement of single and married students. The data indicate that the single students were

TABLE V

CHI-SQUARE ANALYSIS OF THE RELATION OF MARITAL STATUS
TO ACHIEVEMENT

Grouping	Probationary	Non-probationary	Total	x^2
Single	181	202	383	5.01
Married	76	128	204	
Total	257	330	587	

Chi-square is significant at the 5 per cent level of confidence.

rather evenly divided between the probationary and non-probationary groups, whereas proportionately fewer married students incurred probation. These differences, moreover, were significant at the 5 per cent level of confidence. Perhaps the better performance of married students may be attributed to the increased motivation or the earlier maturity which result from the added responsibilities which marriage entails.

Since single students tended to incur probation significantly more often than married students in this sample, there is sufficient evidence to refute the hypothesis of no difference in the achievement of single and married students.

Native Country and Achievement.- Is the native country significantly related to achievement?

The application forms were consulted to determine the native countries of the entire array of students. It should be pointed out that the term "native country," as employed in this study, designates the student's country of birth and not the country of which he happens to be a citizen at the time of his first enrollment in the graduate school. That this distinction is necessary is evident from the fact that, as an aftermath of World War II, many foreign students have been admitted either as displaced persons or as citizens of other countries.

As we have seen there were no fewer than 55 different countries represented in the universe (Table I, Chapter I). China ranked first in the number of foreign students enrolled,

having 226. India was second, with 98, followed by Canada,

Turkey, and the Philippines with 55, 42, and 20, respectively.

The following countries were represented by only one student:

Argentina, Australia, Bolivia, British West Indies, Bulgaria,

Costa Rica, Czechoslovakia, Dominican Republic, Ecuador,

Finland, Guatemala, Haiti, Japan, Malaya, Nicaragua, Norway,

Paraguay, Poland, Roumania, Siam, South Africa, Syria, and

Yucatan.

Table VI represents an analysis of the relation of

the student's native country to achievement. Only those

TABLE VI

CHI-SQUARE ANALYSIS OF THE RELATION OF NATIVE COUNTRY
TO ACHIEVEMENT

Grouping	Probationary	Non-probationary	Total	x^2
Canada	14	41	55	
China	109	117	226	
Egypt	4	15	19	
India	39	59	98	19.65
Philippines	6	14	20	
Turkey	25	17	42	
Total	197	263	460	

Chi-square is significant at the 1 per cent level of confidence.

countries with theoretical frequencies of five or greater were

included in the contingency table. There is considerable evi-

dence to the effect that the chi-square test should not be

computed for data in which the theoretical frequency in any

cell entry is less than five.[1] By applying formula (3), we found a chi-square of 19.65 which, for five degrees of freedom, was significant at the 1 per cent level.

The highest proportion of probationary students came from Turkey, China, and India. We learned in Chapter II that difficulty with the English language might account for the academic difficulties experienced by some of these students. That a considerable number come to the United States with a scant knowledge of English is well-known. For this reason, the English Language Institute was established at the University of Michigan to provide basic instruction for those seeking help in the English language.

A further test of the association between selected native countries and the incidence of probation is presented in Table VII. The means of the number of probations, the

TABLE VII

MEANS AND STANDARD DEVIATIONS OF NUMBER OF PROBATIONS
RECEIVED BY STUDENTS FROM SELECTED COUNTRIES

Grouping	Number of Cases	Mean	Standard Deviation
Canada	14	1.43	.73
China	109	1.72	1.02
Egypt	4	1.75	.83
India	39	1.69	1.09
Philippines	6	2.33	1.60
Turkey	25	1.60	.89
Total	197	1.70	1.03

[1]Guilford, op. cit., p. 279.

standard deviations from the means, and the number of cases for each of the selected countries are indicated.

It may be noted that the probationary students in each of the groups are not all alike with respect to the average number of warnings received. For instance, probationary students from Canada received an average of 1.43 warnings, whereas the probationary students from the Philippines received an average of 2.33 warnings. Between these two extremes are to be found the mean number of warnings incurred by each of the remaining groups. The mean number of warnings received by all probationary students was 1.70.

The analysis of variance technique was applied to these findings in order to determine whether the obtained differences between the several means were significant. The value of F is not significant at the 1 per cent or 5 per cent levels and is consistent with the assumption that the several means are random samples from the same population.

It may be concluded from the evidence presented in Tables VI to VIII inclusive that the native country is

TABLE VIII

ANALYSIS OF VARIANCE OF MEAN NUMBER OF PROBATIONS INCURRED
BY STUDENTS FROM SIX COUNTRIES

Source of Variation	Sum of Squares	df	Estimate of Variance	F
Between groups	2.87	5	.57	.53*
Within groups	206.63	191	1.08	
Total	209.50	196		

* Not significant.

significantly related to achievement only with respect to the tendency of students from certain countries to incur probation at least once during their residence in the graduate school. No significant differences were found, however, in the average number of warnings received by the probationary students from the several native countries studied. This would mean that the probationary students from these countries are essentially alike in the ability to improve their academic standing subsequent to the time of the first warning.

Native Country and Achievement.- Is there any relationship between native country, broadly classified, and achievement?

It has been previously stated that in many instances the numbers of students from several countries were too few to permit statistical treatment. If all students for whom data were available were to be included in the analysis, students from certain areas of the world having cultural similarities would have to be grouped. Table IX presents the groups, or broad geographical classifications, of the various native countries represented in the population of this study. This classification is an adaptation of the scheme formulated by the Institute of International Education for this purpose.[1]

The chi-square test was employed again to determine

[1]Institute of International Education, Education in One World. Census of the Foreign Student Population of the United States, 1949-50, pp. 12-15.

TABLE IX

SCHEME USED FOR BROADLY CLASSIFYING NATIVE COUNTRY

Classification	Countries Included	
Africa:	Egypt	
British Empire:	Australia British West Indies Canada Great Britain Union of South Africa	
Europe:	Austria Belgium Bulgaria Czechoslovakia Denmark Finland France Germany Greece	Holland Hungary Italy Norway Poland Roumania Russia Spain Sweden
Far East:	Burma China Haiti India Japan	Korea Malaya Philippines Siam
Latin America:	Argentina Bolivia Brazil Chile Colombia Costa Rica Cuba Dominican Republic Ecuador	Guatemala Mexico Nicaragua Panama Paraguay Peru Venezuela Yucatan
Near East:	Iran Iraq Israel Syria Turkey	

the existence of a relationship between native country broadly classified and achievement. From the evidence presented in Table VI we would expect that the null hypothesis would again be refuted. Table X confirms our hypothesis. The chi-square of 16.96, for five degrees of freedom, was significant at the 1 per cent level. Only once in 100 trials could we attribute a similar distribution to errors in sampling.

TABLE X

CHI-SQUARE ANALYSIS OF THE RELATION OF NATIVE COUNTRY
(BROADLY CLASSIFIED) TO ACHIEVEMENT

Grouping	Probationary	Non-probationary	Total	x^2
Africa	4	15	19	
British Empire	18	43	61	
Europe	19	28	47	16.96
Far East	155	198	353	
Latin America	26	21	47	
Near East	35	25	60	
Total	257	330	587	

Chi-square is significant at the 1 per cent level.

A closer examination of the statistical analysis reveals that proportionately more students from the Near East, Latin America, and the Far East incurred one or more warnings than did the students representing other geographical groupings. Insufficient knowledge of the English language at the time of entrance might account for some of the academic difficulties experienced. Another possible explanation is that many of these students, particularly the Latin American probationary students, have pursued their undergraduate studies

at institutions which have not qualified them to pursue
graduate work at the University.

Do the probationary students representing the various
geographical areas differ among themselves with respect to
the number of warnings received? Table XI sheds some light
on this question. The means of the number of warnings, the
standard deviations from the means, and the numbers in each
group are indicated.

TABLE XI

MEANS AND STANDARD DEVIATIONS OF NUMBER OF PROBATIONS
DISTRIBUTED AMONG THE VARIOUS GEOGRAPHICAL AREAS

Grouping	Number of Cases	Mean	Standard Deviation
Africa	4	1.75	.83
British Empire	18	1.56	.76
Europe	19	1.74	.96
Far East	155	1.75	1.08
Latin America	26	1.73	.76
Near East	35	1.60	.87
Total	257	1.71	.99

It would appear from the distribution of the means
that students from the British Empire and the Near East re-
ceived fewer repeated warnings than did the other students.
For instance, students from the British Empire and the Near
East received an average of 1.56 and 1.60 warnings, respectively,
whereas students from Africa and the Far East had an average
of 1.75 warnings. The mean of the warnings received by the
entire array of probationary students in our sample was 1.71.

The analysis of variance test was used to determine

whether the differences among the means for the several pro-
bationary groups were significant. Table XII shows that the
mean square for the between groups divided by the mean square

TABLE XII

ANALYSIS OF VARIANCE OF MEAN NUMBER OF PROBATIONS INCURRED BY
STUDENTS FROM THE VARIOUS GEOGRAPHICAL GROUPS

Source of Variation	Sum of Squares	df	Estimate of Variance	F
Between groups	2.65	5	.53	.53
Within groups	250.95	251	1.00	
Total	253.60	256		

F is not significant.

for the within groups resulted in an F value of .53 which was
not significant. It would appear that the several means could
be random samples from the same population. Stated somewhat
differently, the null hypothesis, i.e., that there are no
differences in the mean number of warnings distributed among
the native countries broadly classified, is not refuted for
the evidence is in its favor.

The obvious conclusion from Tables X to XII inclusive
is that the native country broadly classified is related to
achievement only with respect to the probability that students
from certain geographic areas will be placed on probation at
some time during their residence in graduate school. The
several probationary groups, however, are essentially similar
in the average number of warnings received. Perhaps the

improvement made by probationary foreign students in their subsequent achievement, irrespective of the native country, may be attributed to the counseling these students receive from administrators, teachers, and their American friends. Another possible explanation is that the initial language handicap faced by students from certain countries is no longer present.

Employment Status and Achievement.- Is the academic achievement of employed students superior to that of students who are not employed?

In Chapter II we noted that several investigators have studied the relation between outside work and achievement. Where differences were reported they were invariably in favor of the employed students. Crawford[1] has ascribed these differences to the fact that students working their way are more highly motivated than those who are not. He was able to reach "... a definite conclusion that the academic success of students, as measured by their classroom grades, is inversely related to their financial advantage."[2]

Table XIII shows the relationship between employment status and achievement. An inspection of the frequencies indicates that the great majority of foreign students were not employed. For instance, of the 562 individuals for whom data were available, only 79 or 14 per cent were engaged

[1] Crawford, op. cit., p. 50.

[2] Ibid.

in outside work.

TABLE XIII

CHI-SQUARE ANALYSIS OF THE RELATION OF EMPLOYMENT STATUS TO ACHIEVEMENT

Grouping	Probationary	Non-probationary	Total	x^2
Employed	30	49	79	.58
Not employed	209	274	483	
Total	239	323	562	

Chi-square is not significant.

The results of the chi-square test indicate that there is no significant relationship between employment and grades earned by foreign students at the graduate level. We may conclude that the achievement of employed students in our sample was not meaningfully superior to that of students who were not employed.

Type of Admission and Achievement.- Is the type of admission received significantly related to achievement?

The type of admission received by the entire array of students was determined by consulting the personal folders on file in the office of the Graduate School.

It is the practice of many graduate schools to admit "provisionally" those students who fail to meet one or more of the requirements for regular admission. The Horace H. Rackham School of Graduate Studies, during the period covered in this study, admitted some students provisionally for the following reasons: (1) low undergraduate record; (2) prior academic work pursued at an unaccredited

institution; (3) lack of preparation in the specific field designated for graduate study; and (4) applicant not working toward an advanced degree.

That provisional admission is the exception rather than the rule is apparent from the data presented in Table XIV. The students admitted provisionally constituted only 11 per cent of the entire population with which this study is dealing.

TABLE XIV

CHI-SQUARE ANALYSIS OF THE RELATION OF TYPE OF
ADMISSION TO ACHIEVEMENT

Grouping	Probationary	Non-probationary	Total	x^2
Regular	218	302	520	
Provisional	39	28	67	5.75
Total	257	330	587	

Chi-square is significant at the 5 per cent level.

The result of the chi-square test indicates a predictive relationship between the type of admission and the incidence of probation. The provisionally admitted students tended to incur probation more frequently than the students who received regular admission. A chi-square of 5.75 with one degree of freedom is significant at the 5 per cent level of confidence. The null hypothesis is therefore refuted for there is sufficient evidence against it.

The obvious conclusion is that the type of admission received is significantly related to the subsequent achievement

of foreign graduate students.

Degree Held at Admission and Achievement.- Is the degree held at admission significantly related to achievement?

We would expect that students who earned advanced degrees in their native countries prior to admission would be less likely to incur probation than the students who entered with baccalaureate degrees only. Table XV shows the relationship between degree held at admission and achievement. As expected, chi-square was significant at the 1 per cent level. Our hypothesis that students entering with advanced degrees are superior in their subsequent achievement was supported by the evidence.

TABLE XV

CHI-SQUARE ANALYSIS OF THE RELATION OF THE DEGREE HELD AT ADMISSION AND ACHIEVEMENT

Grouping	Probationary	Non-probationary	Total	x^2
Bachelors	228	251	479	
Masters	13	49	62	17.45
Doctors	16	30	46	
Total	257	330	587	

Chi-square is significant at the 1 per cent level.

A closer perusal of the statistical analysis reveals that one out of two students entering with bachelors degrees incurred probation, whereas only one out of five students with masters and one out of three students with doctorates experienced similar academic difficulties. Perhaps the

additional training that the advanced degrees represent places these students in a more favorable position to compete with American students.

We would also expect that, among the probationary groups, the students who entered with advanced degrees would incur fewer repeated academic warnings. Table XVI presents

TABLE XVI

MEANS AND STANDARD DEVIATIONS OF NUMBER OF PROBATIONS
AND DEGREE STATUS AT ADMISSION

Grouping	Number of Cases	Mean	Standard Deviation
Bachelors	228	1.73	1.00
Masters	13	1.92	1.07
Doctors	16	1.31	.58
Total	257	1.71	.99

the evidence on this point. The means and standard deviations of the number of warnings incurred by the various degree groups are indicated. As expected, the students who entered with doctorates had the lowest average number of probations, namely, 1.31. It is surprising to note, however, that the students who entered with masters degrees were slightly inferior to those entering with baccalaureates. The reason for this "reversal" in expected results is not readily apparent.

The analysis of variance test was used to determine whether the differences among the means of the probationary groups were significant. Table XVII shows that the estimate

TABLE XVII

ANALYSIS OF VARIANCE OF MEAN NUMBER OF PROBATIONS INCURRED AND DEGREE STATUS AT ADMISSION

Source of Variation	Sum of Squares	df	Estimate of Variance	F
Between groups	4.73	2	2.36	2.41
Within groups	248.87	254	.98	
Total	253.60	256		

F is not significant.

of variance for the between groups was not sufficiently greater than the estimate of variance for the within groups to result in a statistically significant F. The null hypothesis of no difference among the several groups is therefore not refuted.

From the evidence presented in Tables XV to XVII inclusive, it may be concluded that the degree held at admission is significantly related to achievement only with reference to the fact that a proportionately greater number of students with advanced degrees are "non-probationary." Among the probationary students, however, there are no significant differences between the several degree groups in the mean number of warnings received.

Financial Aid and Achievement.- Are students who enter with financial aid (scholarships, fellowships) less likely to incur probation?

It has recently become the practice of many graduate schools to ascertain whether the foreign applicant for

admission has sufficient financial resources to complete his proposed program of study. Administrators have learned the necessity for doing so from the number of foreign students whose money has been exhausted after one or more semesters. Fortunately several foreign governments and the United States have provided a partial preventative for this situation. India, Iran, the Philippines, and some of the Latin-American countries have instituted the practice of awarding their better students government scholarships. Likewise, the United States, through the Institute of International Education and similar agencies, has also sought to attract the more capable foreign students as a feature of its program of improving international understanding.

Is the basis upon which these "government scholars" are selected justified by their subsequent achievement? Table XVIII provides us with an answer to this question.

TABLE XVIII

CHI-SQUARE ANALYSIS OF THE RELATION OF FINANCIAL
AID TO ACHIEVEMENT

Grouping	Probationary	Non-probationary	Total	x^2
Scholarship	48	101	149	8.49
No scholarship	195	225	420	
Total	243	326	569	

Chi-square is significant at the 1 per cent level.

Of the 569 students for whom data were available, 149 or 26 per cent entered with some form of scholarship. It was

expected that scholarship students would be less likely to incur probation than non-scholarship students. This assumption was supported by the difference in the percentages of those on probation within these two categories. Chi-square was significant at the 1 per cent level. The probability that a similar distribution could be obtained as a result of accidents in random sampling is quite small.

Is there any significant difference in the mean number of warnings received by the two probationary groups - scholarship holders versus non-scholarship holders? Table XIX shows that even within the probationary group, the scholarship students tended to incur fewer repeated probationary actions. The scholarship students had a mean of 1.46 warnings, whereas the non-scholarship students had a mean of 1.75 warnings. The difference was not statistically significant, however, and the null hypothesis is retained.

TABLE XIX

SIGNIFICANCE OF DIFFERENCE OF MEAN NUMBER OF WARNINGS RECEIVED
BY PROBATIONARY SCHOLARSHIP AND NON-SCHOLARSHIP STUDENTS

Classification	Number of Cases	Mean	t
Scholarship	48	1.46	.60[#]
No scholarship	195	1.75	

[#] Not significant.

The obvious conclusion from Tables XVIII and XIX is that a proportionately greater number of scholarship students are free from disciplinary action than are the non-scholarship

students. For the probationary students in the sample, the evidence that the scholarship students incurred fewer repeated warnings was not sufficient to reject the null hypothesis. Stated somewhat differently, the probationary scholarship and non-scholarship students were essentially alike in the mean number of warnings received.

Relation of Scholastic Factors to Achievement

Are selected scholastic factors significantly related to the academic difficulties experienced by foreign graduate students? It was expected that probationary and non-probationary students would differ, in some instances, with reference to the scholastic variables chosen for study. The analysis and interpretation of the various scholastic factors as they relate to achievement are indicated below.

Degree Earned at Michigan and Achievement.- Is the incidence of probation inversely related to the educational level of the degree earned at the University of Michigan?

The transcripts on file in the office of the Registrar were consulted to ascertain the degrees earned. Of the entire array of 587 graduate students in our sample, 102 or approximately 18 per cent did not earn graduate degrees. The great majority of foreign students, viz., 403 or 67 per cent, earned masters degrees. Only 82 students, or roughly 14 per cent of our sample, earned doctorates.

The chi-square test of significance was employed to determine the relationship between degree earned and probationary

status. We would expect that students who earned doctorates would be less likely to incur probation. Conversely, we would expect that students who did not earn graduate degrees would be more likely to have experienced academic difficulties at some time during their residence in graduate school. The evidence presented in Table XX confirms these notions. The

TABLE XX

CHI-SQUARE ANALYSIS OF THE RELATION OF DEGREES EARNED AT MICHIGAN TO ACHIEVEMENT

Classification	Probationary	Non-probationary	Total	x^2
No degree	81	21	102	
Masters	163	240	403	80.42
Doctors	13	69	82	
Total	257	330	587	

Chi-square is significant at the 1 per cent level.

incidence of probation was proportionately higher among the "no degree" students and proportionately lower for the "masters" and "doctors," the latter being the group which was least likely to incur probationary action. Chi-square was significant at the 1 per cent level. This would indicate that a similar distribution could be expected on the basis of chance only once in 100 trials.

Moreover, the "no degree" students were more likely to incur repeated warnings for low academic performance than were the students who earned degrees. Table XXI indicates that there is a progressive diminution in the mean number of

TABLE XXI

MEANS AND STANDARD DEVIATIONS OF NUMBER OF PROBATIONS INCURRED AND DEGREES EARNED AT MICHIGAN

Classification	Number of Cases	Mean	Standard Deviation
No degree	81	2.04	1.10
Masters	163	1.58	.89
Doctors	13	1.38	.84
Total	257	1.71	.99

warnings received as the degree status of the students rises. The "no degree" students had a mean of 2.04 warnings, the "masters," 1.58 warnings, and the "doctors," 1.38.

The analysis of variance test was employed to determine whether the between group differences in mean number of probations were greater than the within group differences. Table XXII indicates that the estimate of variance for the

TABLE XXII

ANALYSIS OF VARIANCE OF MEAN NUMBER OF PROBATIONS CLASSIFIED ACCORDING TO DEGREES EARNED AT MICHIGAN

Source of Variation	Sum of Squares	df	Estimate of Variance	F
Between groups	15.10	2	7.55	8.03
Within groups	238.50	254	.94	
Total	253.60	256		

F is significant at the 1 per cent level.

between groups was significantly greater than the estimate of variance for within groups. More precisely, F was significant at the 1 per cent level of confidence, and we are therefore justified in rejecting the null hypothesis of no difference between the several means tested. One explanation for this progressive decrease in number of probations may be that only the more capable foreign students are encouraged to work toward the advanced degrees.

In Chapter III it was pointed out that a significant F does not necessarily imply that all the obtained means are significantly different from each other. In order to determine which of the means for the three degree groups differed significantly, the usual "t" test was used. Table XXIII shows

TABLE XXIII

SIGNIFICANCE OF DIFFERENCES IN MEAN NUMBER OF WARNINGS INCURRED BY PROBATIONARY STUDENTS IN THREE DEGREE CATEGORIES

Classification	Lower Mean[1]	Higher Mean	In Favor Of	t
No degree vs. masters	1.58	2.04	Masters	3.47**
No degree vs. doctors	1.38	2.04	Doctors	2.00*
Masters vs. doctors	1.38	1.58	Doctors	.75

1. The lower mean indicates higher achievement.
 * Significant at the 5 per cent level.
** Significant at the 1 per cent level.

the significance of the difference in the mean number of probations received by the three degree groups. In each instance the group with the higher degree was favored, although not

always with the same statistical confidence. Moreover, students who earned either masters or doctorates incurred significantly fewer repeated warnings than students who did not earn degrees. For example, in comparing the means of the "no degree" group and the "masters" group, a difference significant at the 1 per cent level of confidence was obtained.

From the evidence presented in Tables XX to XXIII inclusive we may conclude that the probationary and non-probationary students differ significantly with reference to degrees earned at the University. The non-probationary students in our sample were more likely to earn graduate degrees. Additional differences were found in the mean number of warnings received by the probationary students in the three degree categories. As expected, the students who earned advanced degrees were less likely to incur repeated probationary action than were the students who did not earn degrees.

Enrollment During Which First, Second, Third, and Fourth Warnings Were Received and Degrees Earned.- Are probationary students more likely to incur disciplinary action early in their academic program? Are there any differences in the distribution of warning letters for the three degree categories? Tables XXIV to XXVII inclusive present the evidence which provides us with an answer to these questions.

It may be noted from Table XXIV that probationary students are more apt to experience initial academic failure during the first enrollment than at any other time during

TABLE XXIV

INCIDENCE OF FIRST WARNING AND DEGREES EARNED AT MICHIGAN

Classification	Enrollment during which first warning incurred								Total
	1	2	3	4	5	6	7	8	
No degree	71	5	3	1	-	-	-	1	81
Masters	94	30	22	12	2	3	-	-	163
Doctors	5	3	2	2	1	-	-	-	13
Total	170	38	27	15	3	3	-	1	257

TABLE XXV

INCIDENCE OF SECOND WARNING AND DEGREES EARNED AT MICHIGAN

Classification	Enrollment during which second warning incurred								Total
	1	2	3	4	5	6	7	8	
No degree	-	36	8	2	1	-	-	-	47
Masters	-	24	17	12	8	3	-	1	65
Doctors	-	-	1	1	-	1	-	-	3
Total	-	60	26	15	9	4	-	1	115

TABLE XXVI

INCIDENCE OF THIRD WARNING AND DEGREES EARNED AT MICHIGAN

Classification	Enrollment during which third warning incurred								Total
	1	2	3	4	5	6	7	8	
No degree	-	-	15	6	3	-	-	-	24
Masters	-	-	4	6	5	2	-	1	18
Doctors	-	-	-	-	-	-	1	-	1
Total	-	-	19	12	8	2	1	1	43

TABLE XXVII

INCIDENCE OF FOURTH WARNING AND DEGREES EARNED AT MICHIGAN

Classification	Enrollment during which fourth warning incurred								Total
	1	2	3	4	5	6	7	8	
No degree	-	-	-	7	1	3	-	-	11
Masters	-	-	-	1	3	2	1	-	7
Doctors	-	-	-	-	-	-	-	1	1
Total	-	-	-	8	4	5	1	1	19

their subsequent residence in the graduate school. No fewer
than 170 students or 66 per cent of the total number in the
probationary sample received their first warning letter for
academic deficiencies during this period. A closer inspection
of the data reveals some differences in the incidence of the
first probationary action among the three degree categories.
Seventy-one or 88 per cent of the students in the "no degree"
category were warned during the first enrollment, whereas 94
or 58 per cent of the students who earned masters degrees
and only five or 38 per cent of the students who obtained
doctorates were warned during this same period.

The evidence presented in Table XXV indicates that
no fewer than 115 students or 45 per cent of the 257 pro-
bationary students in our sample incurred a second probation-
ary action. Moreover, more than half of these students in-
curred the second disciplinary action during the second
enrollment. Furthermore, certain differences were found in
the incidence of the second warning among the students in
the three degree categories. Students who earned doctorates,
in particular, showed a less noticeable tendency to remain
on probation. It may be noted in passing that only three
students who earned doctorates received a second warning for
low grades.

A plausible explanation for this preponderance of
academic failure during the first and second enrollments,
particularly among the "no degree" students, is the problem
of adjustment which confronts most foreign students who enroll

in American universities. Not only must foreign students
familiarize themselves with American educational standards
but they must also become adjusted to other aspects of life
in an American community. Inadequate knowledge of the English
language, financial worries, inability to find adequate
living accommodations, and difficulty in meeting American
students are but some of the problems which beset the typical
student from abroad. There are individual differences, how-
ever, in the ease with which these problems are met. It
would seem that the students who earned advanced degrees were
able to make a more rapid and satisfactory adjustment to their
new surroundings. Particularly were the students who earned
doctorates less likely to suffer in their academic studies
during their first residence in the graduate school.

Tables XXVI and XXVII indicate the incidence of the
third and fourth warnings, respectively. The distribution of
the third and fourth warnings among the students who did not
earn degrees was concentrated in the third and fourth enroll-
ments, respectively. The incidence of the third and fourth
warnings among the students who earned advanced degrees, how-
ever, showed a tendency to be more randomly distributed.

The obvious conclusion from Tables XXIV to XXVII in-
clusive is that the great majority of probationary students
experienced academic difficulties during the first and second
enrollments. As noted previously, there was a noticeable
difference in the incidence of probation among the students
in the three degree categories. Students who did not earn

degrees incurred more repeated warnings. Conversely, students

who earned advanced degrees were less likely to incur re-

peated probationary action. Furthermore, the distribution

of the third and fourth warnings was rather uniform for the

"no degree" students, whereas the incidence of the same warn-

ings among the "degree" students approximated a more random

distribution.

Field of Concentration and Achievement.- Are foreign

students who are enrolled in certain departments more likely

to experience academic failure?

It was noted in Chapter II that several investigators

have found a significant relationship between field of con-

centration and grades earned. There was no general agreement,

however, as to the specific departments in which the aca-

demically superior students were to be found. These con-

flicting findings may be attributed in part to the differences

in standards for grading among the several institutions

studied and among the various departments within a single

institution. The results of the chi-square test of the re-

lationship between certain fields of study and the achieve-

ment of foreign students are presented in Table XXVIII. Only

those fields with theoretical frequencies of five or more

were selected for study.

By consulting the appropriate tables it was found

that a chi-square of 35.26, for 12 degrees of freedom, was

significant at the 1 per cent level of confidence. This would

mean that the field of concentration was significantly related

TABLE XXVIII

CHI-SQUARE ANALYSIS OF THE RELATION OF SELECTED FIELDS OF CONCENTRATION TO ACHIEVEMENT

Grouping	Pro-bationary	Non-probationary	Total	x^2
Aeronautical Engineering	5	6	11	
Chemical Engineering	22	34	56	
Chemistry	14	10	24	35.26
Civil Engineering	40	47	87	
Economics	30	14	44	
Education	11	17	28	
Electrical Engineering	16	36	52	
English	10	10	20	
Mathematics	3	13	16	
Mechanical Engineering	27	41	68	
Physics	10	4	14	
Political Science	14	4	18	
Zoology	4	10	14	
Total	206	246	452	

Chi-square is significant at the 1 per cent level.

to the achievement of the students in our sample. The null hypothesis can therefore be rejected with the assurance that only once in 100 trials would we be wrong in so doing.

A closer examination of the table entries reveals that the largest percentages of probationary students were found in political science, physics, economics, chemistry, and English, in that order. Perhaps the high incidence of probation in political science, economics, and English may be attributed to the preponderance of verbal content in these fields which places foreign students with an initial language handicap at a disadvantage. A plausible explanation for the failure experienced by students majoring in physics

and chemistry is that they were ill-prepared in their under-
graduate studies to pursue advanced training in these fields.
It is a well-known fact to most administrators that a con-
siderable number of foreign universities lack adequate
laboratory facilities for experimentation in the physical
sciences.

In order to determine whether students in certain
departments were more likely to incur repeated probationary
action, the mean number of warnings distributed among the
several fields of study had to be determined. The means and
standard deviations of the number of warnings are indicated
in Table XXIX.

TABLE XXIX

MEANS AND STANDARD DEVIATIONS OF NUMBER OF PROBATIONS IN-
CURRED BY STUDENTS IN SELECTED FIELDS OF CONCENTRATION

Classification	Number of Cases	Mean	Standard Deviation
Aeronautical Engineering	5	2.40	1.20
Chemical Engineering	22	1.55	.89
Chemistry	14	1.71	.80
Civil Engineering	40	1.40	.58
Economics	30	1.93	1.18
Education	11	1.91	1.24
Electrical Engineering	16	2.31	1.44
English	10	1.50	.92
Mathematics	3	2.67	1.70
Mechanical Engineering	27	1.59	.83
Physics	10	1.60	.66
Political Science	14	1.57	.90
Zoology	4	1.75	.83
Total	206	1.71	1.01

It is obvious that among the probationary students in our sample, those in mathematics, aeronautical engineering, and electrical engineering tended more to experience repeated disciplinary actions. The means for these three fields of study were 2.67, 2.40 and 2.31 warnings, respectively. It may be noted in passing that these fields are similar in that they all require ability in numerical reasoning.

The analysis of variance test was again employed to determine whether the differences between the means of the several samples were significant. Table XXX shows that the

TABLE XXX

ANALYSIS OF VARIANCE OF MEAN NUMBER OF PROBATIONS INCURRED
BY STUDENTS IN SELECTED FIELDS OF CONCENTRATION

Source of Variation	Sum of Squares	df	Estimate of Variance	F
Between groups	19.45	12	1.62	1.62
Within groups	193.92	193	1.00	
Total	213.37	205		

F is not significant.

value of F was not significant at the 1 or 5 per cent levels of confidence. The evidence was not sufficient, therefore, to enable us to reject the null hypothesis. We are justified in assuming that the means were random samples from a parent population.

It may be concluded from the evidence presented in Tables XXVIII to XXX inclusive that foreign students enrolled

in certain departments of the University are more likely to incur probationary status? There are no significant differences, however, in the distribution of the mean number of warnings among students in the various fields of concentration selected for study.

Field of Concentration Broadly Classified and Achievement.- Is there any relationship between the fields of concentration broadly classified and achievement?

There were no fewer than 48 different fields of concentration represented in our sample (Table II, Chapter I). Civil engineering ranked first in numbers of foreign students enrolled, having 87. Mechanical engineering was second with 68, followed by chemical engineering, electrical engineering, economics, and education with 56, 52, 44, and 28, respectively. At the other extreme of the distribution were several fields of concentration represented by one individual. The enrollment in the following departments was limited to one student: anthropology, crown and bridge prosthesis, journalism, music, ophthalmology, oral surgery, philosophy, and Russian.

It is obvious that several departments in the Horace H. Rackham School of Graduate Studies were not sufficiently represented in our population to yield to statistical treatment. In order to include in the analysis all students for whom data were available, a scheme was employed for broadly classifying the various fields of study represented in our population. Table XXXI presents the scheme employed in this project for this purpose. This classification is an

TABLE XXXI

SCHEME EMPLOYED FOR BROADLY CLASSIFYING FIELDS OF CONCENTRATION

Grouping	Specific Fields of Concentration Included	
Physical Sciences	Astronomy Chemistry Geology Mathematics Physics	

Biological Sciences	Anatomy
	Bacteriology
	Biological Chemistry
	Botany
	Crown and Bridge
	   Prosthesis
	Dentistry for Children
	
	Forestry
	Internal Medicine
	Obstetrics & Gynecology
		Ophthalmology
		Oral Pathology
		Oral Surgery
		Orthodontics
		Pharmaceutical
		   Chemistry
		
		Physiology
		Surgery
		Zoology

Social Sciences	Anthropology Economics Education History Journalism	Library Science Philosophy Political Science Psychology Sociology
Humanities	English French German Linguistics	Music Russian Spanish Speech
Engineering	Aeronautical Engineering Architecture Chemical Engineering Civil Engineering	Electrical Engineering Engineering Mechanics Mechanical Engineering Naval Architecture

adaptation of the scheme formulated by the Institute of
International Education for this purpose.[1]

The chi-square test was employed to determine whether
there was a significant difference in the percentages of pro-
bationary and non-probationary students to be found among the
various broad areas of study. From the evidence presented in
Table XXVIII we would expect that the null hypothesis would
again be refuted. The expected outcome is supported by the
data presented in Table XXXII. The chi-square of 10.44, for

TABLE XXXII

CHI-SQUARE ANALYSIS OF THE RELATION BETWEEN BROAD AREAS
OF STUDY AND ACHIEVEMENT

Classification	Probationary	Non-probationary	Total	x^2
Physical Sciences	31	30	61	
Biological Sciences	26	42	68	10.44
Social Sciences	69	58	127	
Humanities	14	25	39	
Engineering	117	175	292	
Total	257	330	587	

Chi-square is significant at the 5 per cent level.

four degrees of freedom, was significant at the 5 per cent
level. This means that the observed differences are such that
only five times in 100 might they occur by chance, i.e., as
a result of sampling variation.

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[1] Institute of International Education, Education in
One World. Census of the Foreign Student Population of the
United States, 1949-50, pp. 22-24.

A closer inspection of the data reveals that a proportionately greater number of students majoring in the social sciences and physical sciences incurred academic failure, whereas a proportionately smaller number of the students majoring in the humanities experienced similar academic difficulties. It was noted above that investigators are not in accord as to the subject-matter areas in which students experience the greatest amount of difficulty. In the absence of any such agreement, it is not readily apparent why there is a proportionately greater concentration of probationary students in the social sciences and physical sciences. As stated for fields of concentration (Table XXIX), perhaps insufficient knowledge of the English language may explain much of the academic failure experienced by these students, particularly those enrolled in the social sciences.

Are there any differences in the average number of warnings distributed among various academic areas broadly classified? The data presented in Table XXXIII enables us

TABLE XXXIII

MEANS AND STANDARD DEVIATIONS OF NUMBER OF PROBATIONS
DISTRIBUTED AMONG BROAD AREAS OF STUDY

Grouping	Number of Cases	Mean	Standard Deviation
Physical Sciences	31	1.84	.95
Biological Sciences	26	1.65	.87
Social Sciences	69	1.84	1.11
Humanities	14	1.43	.82
Engineering	117	1.65	.95
Total	257	1.71	.99

to answer this question in the affirmative.

A closer inspection of the evidence reveals that, among the probationary students, those majoring in the physical sciences and the social sciences were more likely to incur repeated probationary action. The mean number of warnings received by students in both of these subject-matter areas was 1.84. Furthermore, students majoring in the humanities received fewer disciplinary actions than the students in all other probationary groups, or an average of 1.43 warnings.

The analysis of variance test was used to ascertain whether the obtained differences between the several means were significant. Table XXXIV shows that the estimate of

TABLE XXXIV

ANALYSIS OF VARIANCE OF MEAN NUMBER OF PROBATIONS
INCURRED BY STUDENTS IN BROAD AREAS OF STUDY

Source of Variation	Sum of Squares	df	Estimate of Variance	F
Between groups	4.16	4	1.04	1.05
Within groups	249.44	252	.99	
Total	253.60	256		

F is not significant.

variance for the between groups was not sufficiently greater than that of the within groups to result in a statistically significant F. It would appear that the several means could be random samples from the same population. The obvious

conclusion is that the obtained differences between the several means were not significant and the null hypothesis cannot, therefore, be rejected.

We may conclude from the evidence presented in Tables XXXI to XXXIV inclusive that the field of concentration broadly classified is related to achievement only in comparing the performance of probationary and non-probationary students. The several probationary groups, however, are essentially alike in the average number of warnings received.

Student Load and Achievement.- Are there any significant differences between probationary and non-probationary students in the number of hours attempted and earned?

It was noted in Chapter II that several investigators have reported a significant relationship between the course load attempted and achievement. Lehman and Stoke,[1] in particular, found a positive relationship between the number of courses attempted during any enrollment and grades earned. These findings, in part, are also applicable to the foreign graduate students in our sample. The mean number of hours attempted during the first four enrollments by probationary and non-probationary students in the three degree categories are indicated in Table XXXV.

A further examination of the data reveals that the non-probationary students in each degree category, with one exception, attempted more hours during the first and second

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[1] Lehman and Stoke, op. cit., p. 769.

TABLE XXXV

MEAN NUMBER OF HOURS ATTEMPTED BY PROBATIONARY AND NON-PROBATIONARY STUDENTS DURING THEIR FIRST FOUR ENROLLMENTS AND DEGREES EARNED

Classification	First Enrollment			Second Enrollment			Third Enrollment			Fourth Enrollment		
	P	NP	t	P	NP	t	P	NP	t	P	NP	t
No degree	10.11	10.48	.46	10.20	9.87	.33	9.82	6.10	3.55**	8.35	6.43	1.32
Masters	11.85	12.56	2.41*	12.22	12.97	2.69**	10.84	10.95	.32	9.54	9.68	.30
Doctors	9.69	12.22	3.38**	11.54	11.79	.34	10.75	10.02	.56	9.69	9.67	.02

* Significant at the 5 per cent level.
** Significant at the 1 per cent level.

enrollments than the probationary students in the correspond-
ing degree categories. The non-probationary students, however,
with the exception of those who earned masters degrees,
attempted fewer hours during the third and fourth enrollments
than the probationary students.

Few of the differences found in the number of hours
attempted by probationary and non-probationary students were
statistically significant. During the first enrollment, non-
probationary students in both the "masters degree" and
"doctors degree" categories attempted significantly more hours
than the probationary students in the same degree categories.
During the second enrollment, the non-probationary students
who earned masters degrees also attempted significantly more
hours than the probationary students who earned similar
degrees. It is interesting to note, however, that during
the third enrollment, the non-probationary students in the
"no degree" category attempted significantly fewer hours
than the probationary students. A plausible explanation for
this apparent "reversal" in the trend noted is that non-
probationary students in the "no degree" category are faced
with financial difficulties and must reduce their course
load in order to seek outside employment. Lack of funds may
very well be the reason these students, who did not incur
disciplinary action, left the University prior to earning a
degree.

It is interesting to note in passing that the pro-
bationary students in the three degree categories showed a

tendency to increase their course load during their second enrollment. The non-probationary students, with the exception of the students who earned masters degrees, were more likely to attempt fewer hours during the second enrollment than during the first enrollment. Moreover, both probationary and non-probationary students in the three degree categories showed a progressive diminution in the number of hours attempted during each successive enrollment in the graduate school.

While the non-probationary students in our sample showed a tendency to attempt a heavier course load, particularly in the first two enrollments, they attempted a smaller total number of hours than the probationary students. Table XXXVI presents the mean total number of hours attempted by

TABLE XXXVI

SIGNIFICANCE OF DIFFERENCES IN TOTAL NUMBER OF HOURS ATTEMPTED BY STUDENTS IN THE THREE DEGREE CATEGORIES

Classification	Number of Cases	Mean	t
No degree			
Probationary	81	24.49	.65
Non-probationary	21	22.38	
Masters			
Probationary	163	41.19	4.01**
Non-probationary	240	35.99	
Doctors			
Probationary	13	61.92	1.82
Non-probationary	69	53.64	

** Significant at the 1 per cent level.

probationary and non-probationary students in the three degree categories. The higher means for the probationary students may be attributed to the additional courses these students are required to take in order to offset deficiencies in the scholastic average earned. It should be noted, however, that only at the masters level was the difference in the means obtained for the probationary and non-probationary groups significant.

It was pointed out in Chapter II that Jenson[1] and Zagorski[2] reported a positive relationship between the grades of first-year graduate students and the number of hours earned. Table XXXVII presents the mean number of hours earned during the first four enrollments by the probationary and non-probationary students in our population.

Since the great majority of non-probationary students in our sample attempted more hours during their first two enrollments, it is not surprising to discover that these students also earned more hours during this same period. There is no distinct trend, however, in the differences obtained between probationary and non-probationary students in the number of hours earned during the third and fourth enrollments. Not one of the obtained differences in the number of hours earned during the latter enrollments, moreover, was statistically significant.

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[1]Jenson, op. cit., p. 30.

[2]Zagorski, op. cit., p. 12.

TABLE XXXVII

MEAN NUMBER OF HOURS EARNED BY PROBATIONARY AND NON-PROBATIONARY STUDENTS DURING
THEIR FIRST FOUR ENROLLMENTS AND DEGREES EARNED

Classification	First Enrollment			Second Enrollment			Third Enrollment			Fourth Enrollment		
	P	NP	t	P	NP	t	P	NP	t	P	NP	t
No degree	7.26	9.24	1.96*	7.52	9.00	1.25	7.67	5.70	1.44	5.78	6.00	.14
Masters	10.64	12.20	4.84**	11.80	12.68	3.22**	10.39	10.68	.77	8.60	9.18	1.13
Doctors	9.38	11.94	3.54**	11.38	11.68	.38	10.42	9.86	.42	9.46	9.29	.16

* Significant at the 5 per cent level.
** Significant at the 1 per cent level.

Table XXXVIII tests the significance of the differences in the means of the total number of hours earned by probationary and non-probationary students in the three degree categories. The significantly higher means for the probationary students in the masters degree category may again be attributed to the additional courses these students took to improve their scholastic standing.

TABLE XXXVIII

SIGNIFICANCE OF DIFFERENCES IN TOTAL NUMBER OF HOURS EARNED
BY STUDENTS IN THE THREE DEGREE CATEGORIES

Classification	Number of Cases	Mean	t
No degree			
Probationary	81	17.65	.65
Non-probationary	21	19.62	
Masters			
Probationary	163	37.69	2.47*
Non-probationary	240	34.82	
Doctors			
Probationary	13	59.69	1.68
Non-probationary	69	52.17	

* Significant at the 5 per cent level.

From the evidence presented in Tables XXXV to XXXVIII inclusive it may be concluded that significant differences between probationary and non-probationary students in the number of hours attempted and earned were to be found chiefly in the first two enrollments. During this period, the non-probationary students were more likely both to attempt and to earn more hours than the probationary students. The

evidence with respect to the number of hours attempted and earned during the third and fourth enrollments, however, was not decisively in favor of either group.

A further conclusion seems warranted by the evidence. Probationary students, especially those who earned advanced degrees, were more likely both to attempt and to earn a greater total number of hours during their entire residence in the graduate school than non-probationary students.

Length of Residence and Achievement.- Is the length of residence in the graduate school significantly related to achievement?

It was noted above that probationary students, particularly those who earned advanced degrees, tended both to attempt and to earn more hours during their academic residence. We would expect, therefore, that probationary students would also be characterized by a longer period of residence in graduate study. Table XXXIX shows the mean number of enrollments of the probationary and non-probationary students in the three degree categories.

As expected, the probationary students who earned advanced degrees had the higher means. Only at the masters level, however, was a statistically significant difference obtained. In the "no degree" category, moreover, the mean for the probationary students was slightly lower than that for the non-probationary students. A lack of sufficient funds has been previously cited as a possible explanation why some of these non-probationary students leave the

TABLE XXXIX

SIGNIFICANCE OF DIFFERENCES IN MEAN NUMBER OF ENROLLMENTS
OF PROBATIONARY AND NON-PROBATIONARY STUDENTS
IN THE THREE DEGREE CATEGORIES

Classification	Number of Cases	Mean	t
No degree			
Probationary	81	2.62	.39
Non-probationary	21	2.79	
Masters			
Probationary	163	3.99	4.36**
Non-probationary	240	3.19	
Doctors			
Probationary	13	9.46	1.55
Non-probationary	69	8.28	

** Significant at the 1 per cent level.

University without earning a degree.

The obvious conclusion from the data presented is
that the length of residence in the graduate school is sig-
nificantly related to achievement only at the masters level.

Attendance at Summer School and Achievement.- Is
summer school attendance significantly related to achievement?

The transcripts of the entire array of foreign students
were examined to determine which students had attended summer
school at some time during their graduate study. Summer
school attendance was selected as a variable since it is a
common observation that American undergraduate students do
not, by and large, attend during the summer unless "they have
to." An examination of the data presented in Table XL reveals
that no fewer than 377 or 64 per cent of all students in our

sample attended one or more summer sessions. It would therefore seem that summer school attendance by graduate students, at least foreign students, is by no means the exception.

TABLE XL

CHI-SQUARE ANALYSIS OF THE RELATION OF SUMMER SCHOOL
ATTENDANCE TO ACHIEVEMENT

Grouping	Probationary	Non-probationary	Total	x^2
Summer school	173	204	377	1.67
No summer school	84	126	210	
Total	257	330	587	

Chi-square is not significant.

A closer inspection of the statistical analysis reveals that 173 or 67 per cent of the probationary students were enrolled in summer courses, whereas 204 or 62 per cent of the non-probationary students were similarly enrolled. The chi-square test was employed to determine whether the differences in the obtained frequencies were significant. Chi-square was not significant and we cannot therefore reject the null hypothesis. We may conclude that summer school attendance is not significantly related to the academic achievement of the foreign graduate students in our population.

Relation of Probationary Status to Cumulative Grade-Point Ratio.- Do probationary and non-probationary students differ significantly in their over-all average in the Horace H. Rackham School of Graduate Studies?

Table XLI presents the mean cumulative grade-point
ratios for probationary and non-probationary students in the
three degree categories separately and the same information
for all probationary and non-probationary students, irre-
spective of the degrees earned. In each instance, the non-
probationary students had the higher means. The differences,
moreover, were all significant at the 1 per cent level of
confidence.

TABLE XLI

SIGNIFICANCE OF DIFFERENCES IN MEAN CUMULATIVE GRADE-POINT
RATIOS OF PROBATIONARY AND NON-PROBATIONARY STUDENTS
IN THE THREE DEGREE CATEGORIES

Classification	Probationary		Non-probationary		t
	Number of Cases	Mean	Number of Cases	Mean	
No degree	81	3.17	21	6.15	8.49[**]
Masters	163	5.27	240	6.52	18.48[**]
Doctors	13	5.98	69	7.08	5.81[**]
Total	257	4.64	330	6.61	21.64[**]

[**] Significant at the 1 per cent level.

It may be noted that the greatest difference obtained
in comparing the means for probationary and non-probationary
students was in the "no degree" category. The probationary
students in this category had a mean of 3.17, or an over-all
average of C+ in their graduate work, whereas the non-
probationary students had a mean of 6.15, or slightly better
than a B+ over-all average. The differences between

probationary and non-probationary students who earned advanced degrees were less marked, although statistically significant. Finally, the mean for the entire probationary group, 4.64, was approximately two grades lower than the mean for the entire non-probationary group, 6.61.

It would seem that disciplinary action reliably indicated the scholastic competence of the foreign students upon whom it was imposed. These probationary students were not able to improve their academic standing sufficiently to compare favorably with students who had never incurred probation. We may conclude, therefore, that probationary and non-probationary students differ significantly in their over-all average in the Horace H. Rackham School of Graduate Studies.

The Relation of Psychological Test Data to Achievement

It was noted in Chapter I that the Miller Analogies Test, Form G, and the Academic Aptitude Examination, Graduate Level, comprised the testing program of the Horace H. Rackham School of Graduate Studies during the academic years 1947 to 1949 inclusive. All graduate students who were admitted during these years were required to take either of these two graduate aptitude tests at some time during their first enrollment. Unfortunately, a comparison of the two psychological tests on the same foreign graduate student population was not statistically feasible since there was not a sufficient number of individuals to whom both tests had been administered.

Do probationary and non-probationary foreign graduate

students differ significantly in their performance on the
Miller Analogies Test and on the Academic Aptitude Examina-
tion, Graduate Level? The analysis and interpretation of
these aptitude tests as they relate to achievement are indi-
cated below.

Miller Analogies Test and Achievement.- To what ex-
tent, if any, is the Miller Analogies Test useful in predict-
ing the achievement of foreign graduate students?

The mean raw scores on the MAT[1] for probationary and
non-probationary students in the various countries broadly
classified are indicated in Table XLII. A distinct limita-
tion in the data was the absence of any information on pro-
bationary students from Africa.

TABLE XLII

SIGNIFICANCE OF DIFFERENCES IN MEAN MILLER ANALOGIES RAW
SCORES OF PROBATIONARY AND NON-PROBATIONARY STUDENTS
FROM THE VARIOUS COUNTRIES BROADLY CLASSIFIED

Classification	Probationary		Non-probationary		t
	Number of Cases	Mean	Number of Cases	Mean	
Africa	--	--	7	28.43	--
British Empire	5	59.80	8	52.62	.94
Europe	6	34.17	11	54.82	2.37*
Far East	64	25.94	87	31.56	2.48*
Latin America	9	40.56	6	46.67	.64
Near East	17	25.88	14	26.50	.12
Total	101	29.40	133	34.74	2.47*

* Significant at the 5 per cent level.

[1]The customary abbreviation for the Miller Analogies
Test.

As expected, differences which were significant were
in favor of the non-probationary students. The means for the
non-probationary students who came from Europe and the Far
East were significantly higher than the means for the pro-
bationary students from these same areas. Furthermore, the
mean raw score of all probationary students on the MAT was
29.40, whereas the mean raw score of all non-probationary
students was 34.74. The difference between these two means
was statistically significant at the 5 per cent level.

A comparison of the performance of probationary and
non-probationary students on the MAT who were enrolled in the
various fields of concentration broadly classified is indi-
cated in Table XLIII.

TABLE XLIII

SIGNIFICANCE OF DIFFERENCES IN MEAN MILLER ANALOGIES RAW
SCORES OF PROBATIONARY AND NON-PROBATIONARY STUDENTS
IN THE VARIOUS FIELDS OF CONCENTRATION BROADLY
CLASSIFIED

| Classification | Probationary | | Non-probationary | | t |
	Number of Cases	Mean	Number of Cases	Mean	
Physical Sciences	10	32.50	7	44.43	1.62
Biological Sciences	8	27.25	16	34.25	.97
Social Sciences	31	25.13	20	26.65	.30
Humanities	5	28.80	5	60.60	2.84*
Engineering	47	31.98	85	34.41	.89
Total	101	29.40	133	34.74	2.47*

* Significant at the 5 per cent level.

In all instances, the means of the non-probationary
students showed a tendency to be higher than the means of the

probationary students. Moreover, the difference in mean raw scores of probationary and non-probationary students in the humanities was significant at the 5 per cent level of confidence.

It may be called to the reader's attention that the term "humanities," as employed in this project, primarily denoted students who were enrolled in the various language departments of the University (Table XXXI). Since the Miller Analogies Test is also heavily loaded with a verbal factor, it is not surprising that non-probationary students in the humanities did so well on this test.

A further test of the relationship between scores on the MAT and achievement is presented in Table XLIV. The mean raw scores of probationary and non-probationary students in the three degree categories, irrespective of the native country and field of concentration, are indicated.

TABLE XLIV

SIGNIFICANCE OF DIFFERENCES IN MEAN MILLER ANALOGIES RAW SCORES OF PROBATIONARY AND NON-PROBATIONARY STUDENTS IN THE THREE DEGREE CATEGORIES

Classification	Probationary		Non-probationary		t
	Number of Cases	Mean	Number of Cases	Mean	
No degree	26	31.31	2	21.50	.72
Masters	71	27.94	108	34.55	2.77[**]
Doctors	4	42.75	23	36.78	.58
Total	101	29.40	133	34.74	2.47[*]

[*] Significant at the 5 per cent level.
[**] Significant at the 1 per cent level.

It may be noted that only at the masters degree level was a significant difference between the means of probationary and non-probationary students obtained. The mean for the probationary students who earned a masters was 27.94, whereas the mean for the non-probationary students who earned a similar degree was 34.55. Moreover, this difference in the performance of probationary and non-probationary students was fairly typical of the difference obtained in comparing the entire probationary and non-probationary groups in our population.

It is not readily apparent why the probationary students in the "no degree" and "doctors degree" categories received higher mean scores on the MAT than the non-probationary students in the same categories. Perhaps the small number of observations in these categories might account for the "reversal" in expected results.

From the evidence presented in Tables XLII to XLIV inclusive it may be concluded that the two groups of foreign students in our sample, probationary and non-probationary, differed significantly in their performance on the Miller Analogies Test. A further breakdown of foreign students according to the native country broadly classified, broad area of study, and degree earned at Michigan revealed few additional significant differences between probationary and non-probationary students.

Academic Aptitude Examination, Graduate Level, and Achievement.- Is the performance of foreign students on the

Academic Aptitude Examination, Graduate Level, significantly

related to achievement?

It was pointed out in Chapter I that the AAEGL[1]

yielded a verbal ability score and a numerical ability score,

as well as the customary total score for the entire test.

The findings concerning the predictive value of part and

total scores on this test are indicated below.

A. Verbal Part Score

Table XLV shows the mean verbal part scores of pro-

bationary and non-probationary students from the various

TABLE XLV

SIGNIFICANCE OF DIFFERENCES IN MEAN VERBAL PART SCORES OF
PROBATIONARY AND NON-PROBATIONARY STUDENTS FROM THE
VARIOUS COUNTRIES BROADLY CLASSIFIED

| Classification | Probationary | | Non-probationary | | t |
	Number of Cases	Mean	Number of Cases	Mean	
Africa	2	15.00	2	26.00	1.02
British Empire	4	68.75	11	74.36	.64
Europe	5	56.00	8	61.75	.44
Far East	47	31.04	64	34.77	1.24
Latin America	5	45.80	6	56.00	1.06
Near East	7	35.00	4	37.75	.35
Total	70	35.97	95	42.91	2.16*

* Significant at the 5 per cent level.

countries broadly classified. In every instance the non-

probationary students had the higher mean. Non-probationary

[1]A convenient abbreviation, for our purposes, of the
Academic Aptitude Examination, Graduate Level.

students from Africa and Latin America, in particular, seemed to enjoy an advantage over the probationary students from the same areas. However, only a comparison of probationary and non-probationary students irrespective of geographical area showed a difference which was significant at the 5 per cent level. The entire number of probationary students had a mean verbal score of 35.97 as compared with the mean of 42.91 for the entire number of non-probationary students.

A further analysis of the relationship between verbal part score and achievement is presented in Table XLVI. The

TABLE LXVI

SIGNIFICANCE OF DIFFERENCES IN MEAN VERBAL PART SCORES OF
PROBATIONARY AND NON-PROBATIONARY STUDENTS IN THE
VARIOUS FIELDS OF CONCENTRATION BROADLY
CLASSIFIED

Classification	Probationary		Non-probationary		t
	Number of Cases	Mean	Number of Cases	Mean	
Physical Sciences	9	46.44	7	46.43	.00
Biological Sciences	6	41.17	12	52.67	1.01
Social Sciences	15	30.07	15	51.60	2.83**
Humanities	4	55.50	11	57.36	.15
Engineering	36	32.78	50	34.28	.45
Total	70	35.97	95	42.91	2.16*

* Significant at the 5 per cent level.
** Significant at the 1 per cent level.

means for probationary and non-probationary students in the several broad areas of study are indicated.

It is readily apparent that in all categories but one the non-probationary students had the higher mean. The single

exception pertained to students enrolled in the physical sciences, although the means for both groups, for all practical purposes, were alike. It is interesting to note, moreover, that the only significant difference in the mean verbal part scores pertained to students who were enrolled in the social sciences. The mean for probationary students was 30.07, whereas the mean for non-probationary students was 51.60, a difference of 21.53. A plausible explanation for this finding is that the social sciences require a greater facility with language than do some of the other broad academic areas studied.

An additional test of the relationship between verbal part scores and achievement is presented in Table XLVII.

TABLE XLVII

SIGNIFICANCE OF DIFFERENCES IN MEAN VERBAL PART SCORES OF PROBATIONARY AND NON-PROBATIONARY STUDENTS IN THE THREE DEGREE CATEGORIES

Classification	Probationary		Non-probationary		t
	Number of Cases	Mean	Number of Cases	Mean	
No degree	17	34.71	3	62.67	1.78
Masters	52	35.50	83	41.80	1.85
Doctors	1	82.00	9	46.56	1.68
Total	70	35.97	95	42.91	2.16*

* Significant at the 5 per cent level.

The mean raw scores of students in the three degree categories are indicated.

A closer examination of the table entries reveals that there were considerable differences in the means in each degree category, although not one of the differences obtained in comparing the performance of probationary and non-probationary students was significant. The reason for this lack of statistical significance may be attributed to the smallness of the samples. As noted previously, when the means for the entire number of probationary and non-probationary students were compared, a difference in favor of the non-probationary students significant at the 5 per cent level was obtained.

A conclusion which seems warranted by the evidence presented in Tables XLV to XLVII inclusive is that probationary and non-probationary students in our sample differed significantly in their verbal facility as measured by the verbal sub-test of the AAEGL. The performance of the non-probationary students in the social sciences was significantly superior to that of the probationary students in the same courses. Moreover, a further classification of students according to native country broadly classified and degree earned at Michigan did not prove meaningful in pointing out additional differences between probationary and non-probationary students.

B. Numerical Part Score

It has been previously noted that the numerical ability sub-test of the AAEGL purports to measure the examinee's

ability to reason with numbers. The mean verbal raw scores
of students from the several countries broadly classified are
indicated in Table XLVIII.

TABLE XLVIII

SIGNIFICANCE OF DIFFERENCES IN MEAN NUMERICAL PART SCORES OF
PROBATIONARY AND NON-PROBATIONARY STUDENTS FROM
VARIOUS COUNTRIES BROADLY CLASSIFIED

| Classification | Probationary | | Non-probationary | | t |
	Number of Cases	Mean	Number of Cases	Mean	
Africa	2	25.00	2	39.50	1.87
British Empire	4	33.75	11	27.00	.94
Europe	5	25.20	8	18.50	1.66
Far East	47	27.47	64	33.14	2.55*
Latin America	5	13.80	6	18.67	.83
Near East	7	25.43	4	22.50	.47
Total	70	26.41	45	29.97	1.90

* Significant at the 5 per cent level.

A closer inspection of the table entries reveals that
the only significant difference in the means obtained per-
tained to students from the Far East. The mean for probation-
ary students from this area was 27.47, whereas the correspond-
ing mean for non-probationary students was 33.14, a difference
of 5.67. Since the great majority of students from the Far
East were enrolled in the several engineering departments, it
is not surprising to find a significant relationship between
numerical facility and the achievement of Far Eastern students.
A significant difference was not obtained, however, in com-
paring the means of all probationary students versus all
non-probationary students.

A further analysis of the relationship of numerical ability to achievement is presented in Table XLIX. The mean numerical scores of probationary and non-probationary students in the several broad areas of study are indicated.

TABLE XLIX

SIGNIFICANCE OF DIFFERENCES IN MEAN NUMERICAL PART SCORES OF PROBATIONARY AND NON-PROBATIONARY STUDENTS IN THE VARIOUS FIELDS OF CONCENTRATION BROADLY CLASSIFIED

Classification	Probationary		Non-probationary		t
	Number of Cases	Mean	Number of Cases	Mean	
Physical Sciences	9	34.56	7	31.43	.48
Biological Sciences	6	20.50	12	28.42	1.28
Social Sciences	15	19.20	15	22.80	1.02
Humanities	4	24.50	11	16.73	1.39
Engineering	36	28.58	50	35.20	3.00*
Total	70	26.41	95	29.97	1.90

* Significant at the 1 per cent level.

From the previous discussion of the evidence presented in Table XLVIII we would expect that the difference obtained in comparing the means of probationary and non-probationary students in the engineering sciences to be significant. Table XLIX confirms our expectation. The mean for probationary students was 28.58, whereas the mean for non-probationary students was 35.20. The difference in means, 6.62, was significant at the 1 per cent level. These findings are in part supported by those of Travers and Wallace[1]

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[1]Travers and Wallace, op. cit., p. 376.

who reported that the numerical score had the greater predictive value for students majoring in engineering and in the physical sciences.

A further comparison of the mean raw scores of probationary and non-probationary students according to degrees earned at Michigan provides additional information concerning the predictive value of the numerical factor. Table L shows that the non-probationary students in the "no degree" and "masters degree" categories had the higher means. The differences obtained, however, were not statistically significant.

TABLE L

SIGNIFICANCE OF DIFFERENCES IN MEAN NUMERICAL PART SCORES OF PROBATIONARY AND NON-PROBATIONARY STUDENTS IN THE THREE DEGREE CATEGORIES

| Classification | Probationary | | Non-probationary | | t |
	Number of Cases	Mean	Number of Cases	Mean	
No degree	17	24.94	3	35.33	1.29
Masters	52	26.54	83	28.98	1.18
Doctors	1	45.00	9	37.33	.65
Total	70	26.41	95	29.97	1.90

Note: Not one of the differences between means was significant.

The obvious conclusion from the evidence presented in Tables XLVIII to L inclusive is that the numerical ability sub-test of the Academic Aptitude Examination, Graduate Level, has limited value in predicting the achievement of foreign students in the Horace H. Rackham School of Graduate Studies.

The only significant relationships obtained pertained to students who came from the Far East or who were enrolled in the engineering sciences. Moreover, there was no significant difference in the mean numerical raw scores of all probationary versus all non-probationary students.

C. Total Raw Score

The total raw score on the AAEGL consisted of the verbal and numerical part-scores combined. Table LI presents the mean total scores of probationary and non-probationary students from the various countries broadly classified.

TABLE LI

SIGNIFICANCE OF DIFFERENCES IN MEAN TOTAL SCORES OF PROBATIONARY AND NON-PROBATIONARY STUDENTS FROM VARIOUS COUNTRIES BROADLY CLASSIFIED

Classification	Probationary		Non-probationary		t
	Number of Cases	Mean	Number of Cases	Mean	
Africa	2	40.00	2	65.50	1.39
British Empire	4	102.50	11	101.36	.08
Europe	5	81.20	8	80.25	.06
Far East	47	58.51	64	67.91	2.49*
Latin America	5	59.60	6	74.67	1.39
Near East	7	60.43	4	60.25	.02
Total	70	62.39	95	72.87	2.89**

* Significant at the 5 per cent level.
** Significant at the 1 per cent level.

It may be noted that the only significant relationship obtained between total raw score and achievement pertained to students from the Far East. The probationary

students had a mean of 58.51, whereas the non-probationary students had a mean of 67.91, a difference of 9.40. This difference, moreover, was significant at the 5 per cent level of confidence.

When the total numbers of probationary and of non-probationary students were compared, irrespective of origin, a difference significant at the 1 per cent level was obtained. The mean for all probationary students was 62.39, whereas the mean for all non-probationary students was 72.87, a difference of 10.48. A plausible explanation which accounts for this finding is presented in the concluding statements on the predictive value of the Academic Aptitude Examination, Graduate Level.

Table LII presents a further aspect of the relationship between total raw score and achievement. The means of

TABLE LII

SIGNIFICANCE OF DIFFERENCES IN MEAN TOTAL SCORES OF
PROBATIONARY AND NON-PROBATIONARY STUDENTS IN
THE VARIOUS FIELDS OF CONCENTRATION
BROADLY CLASSIFIED

| Classification | Probationary | | Non-probationary | | t |
	Number of Cases	Mean	Number of Cases	Mean	
Physical Sciences	9	81.00	7	77.86	.21
Biological Sciences	6	61.67	12	81.08	1.33
Social Sciences	15	49.27	15	74.40	2.99**
Humanities	4	80.00	11	203.75	.37
Engineering	36	61.36	50	69.48	2.07*
Total	70	62.39	95	72.87	2.89**

* Significant at the 5 per cent level.
** Significant at the 1 per cent level.

probationary and non-probationary students majoring in the various broad academic areas are indicated.

A closer inspection of the table entries reveals that the means for the non-probationary students majoring in the biological sciences, social sciences, humanities, and engineering were considerably higher than the means for the probationary students majoring in the same fields of study. The only significant differences obtained, however, pertained to students who were enrolled in the social sciences and in engineering.

A final comparison of the over-all performance of probationary versus non-probationary students on this test is presented in Table LIII. The mean total raw scores for students in the three degree categories are noted.

TABLE LIII

SIGNIFICANCE OF DIFFERENCES IN MEAN TOTAL SCORES OF PROBATION-
ARY AND NON-PROBATIONARY STUDENTS IN THE THREE DEGREE
CATEGORIES

| Classification | Probationary | | Non-probationary | | t |
	Number of Cases	Mean	Number of Cases	Mean	
No degree	17	59.65	3	98.00	1.93
Masters	52	62.04	83	70.77	2.34*
Doctors	1	127.00	9	83.89	3.03*
Total	70	62.39	95	72.87	2.89**

* Significant at the 5 per cent level.
** Significant at the 1 per cent level.

The means for non-probationary students in the "no degree" and "masters degree" categories were considerably higher than the means for the probationary students in the same categories. At the masters level, moreover, the difference obtained was significant at the 5 per cent level of confidence. It is not readily apparent, however, why the single probationary student who earned a doctorate was significantly superior in his performance on this test. Perhaps factors other than the ability to do graduate work were responsible for his having incurred disciplinary action.

It is obvious from the data presented in Tables LI to LIII inclusive that the over-all performance of the entire array of non-probationary students on the Academic Aptitude Examination, Graduate Level, was significantly superior to that of the probationary students in our sample. A further breakdown of total scores according to native country broadly classified, broad area of study, and degree earned at Michigan yielded but few additional differences which were statistically significant. These additional findings may be enumerated as follows: first, the non-probationary students from the Far East received significantly higher mean total scores than the corresponding probationary students; second, the non-probationary students enrolled in either the social sciences or in engineering were superior to the probationary students enrolled in the same subject-matter areas; third, the non-probationary students who earned masters degrees had significantly higher mean total scores than the probationary students

who earned similar degrees; and finally, the single probation-
ary student who earned a doctorate was superior to the non-
probationary students who earned a similar degree.

A re-examination of the data presented in Tables XLV
to LIII inclusive not only enables us to arrive at tenable
explanations for the above findings but also sheds additional
light on the relative predictive value of the verbal ability
and numerical ability scores, as well as the predictive value
of the total score.

First, it is not surprising to note that the verbal
ability score accounted for the significantly higher total
score of the non-probationary students in the social sciences.
It has been previously stated that a plausible explanation
for this finding is the fact that the social sciences are
characterized by a great amount of verbal content. Further-
more, the verbal ability score also made the greater contri-
bution to the significantly higher total scores of the entire
number of non-probationary students in our sample.

Second, the numerical ability score made the greater
contribution to the total score of the non-probationary
students enrolled in engineering. A tenable explanation may
be that numerical reasoning is more important than facility
with language for the students majoring in this area. This
may also account for the finding that the numerical ability
score had the higher predictive value for the Far Eastern
students, since the great majority of these students were
enrolled in the several engineering departments of the
University.

Third, the evidence is not decisive as to which of the sub-tests, the verbal ability or the numerical ability, made the greater contribution to the total scores received by the non-probationary students who earned masters degrees and the probationary student who earned a doctorate. We may assume that the verbal ability sub-test made the greater contribution, however, since this part-score accounted for the superior over-all performance of the entire number of non-probationary students in our sample.

Finally, a general conclusion which seems to be justified by these findings is that insufficient knowledge of the English language could account for much of the disciplinary action incurred by foreign graduate students.

SUMMARY

The present chapter has concerned itself with a presentation and discussion of the predictive value of selected personal, scholastic, and psychological factors as they relate to the achievement of foreign graduate students enrolled in the Horace H. Rackham School of Graduate Studies. The conclusions, implications, and recommendations for future research which emerge from our findings are indicated in the following chapter.

CHAPTER V

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this study has been to determine the predictive relationship of selected factors to the academic achievement of foreign students. An extensive survey of the literature revealed that there was insufficient knowledge with respect to the qualities that distinguish promising from less promising foreign applicants. The chief value of the present endeavor probably lies in the contribution it may make to the better selection of those foreign students who will profit most from graduate training. The suggestions laid down in this chapter have emerged from the present inquiry into the achievement of foreign students enrolled in the Rackham School of Graduate Studies at the University of Michigan. They will no doubt be modified when additional information bearing upon such achievement becomes available.

Our basic research design was to collect and analyze comprehensive information in an effort to discover if differences in certain personal characteristics, scholastic records, and psychological test data were related to the academic difficulties experienced by foreign students. The original sample consisted of the entire array of foreign students who were enrolled for graduate credit during the academic years 1947 to 1949 inclusive. Those students who were not so enrolled were excluded.

The final sample upon which the findings are based consisted of 257 probationary students who had incurred one or more disciplinary actions and 330 non-probationary students who had, by definition, not experienced academic difficulties during their graduate training. The chi-square, the Fisher-t, and the analysis of variance were principally used to determine the existence of any significant differences between the characteristics of the probationary and the non-probationary groups.

CONCLUSIONS

The following conclusions emerged from the procedures described above:

1. There was no significant association between sex and achievement.

2. Entering age was not significantly related to achievement.

3. There was a predictive relationship between marital status and achievement. Single students exceeded married students to a reliable degree in the likelihood of incurring one or more disciplinary actions.

4. Native country was significantly related to achievements. To a reliable degree, students from Turkey, China, and India were more likely to experience academic difficulties than were students from other countries. No significant differences were obtained, however, in the average number of disciplinary actions received by students from the several

countries represented in this study.

5. There was a significant relationship between geographical area and achievement. To a reliable degree, students who came from the Near East, Latin America, and the Far East were more likely to incur probationary status than were students who represented other geographical areas. No reliable differences were obtained, however, in the mean number of warnings distributed among the several geographical groups studied.

6. Employment status was not significantly related to achievement.

7. There was a predictive relationship between the type of admission and achievement. To a reliable degree, students who received a provisional admission were more likely to incur probation than the students who received a regular admission.

8. The degree held at admission was significantly related to achievement. To a reliable degree, foreign students who entered with advanced degrees conferred in their native countries were less likely to receive disciplinary action than the foreign students who entered with baccalaureates. There were no significant differences, however, in the mean number of warnings received by students who were admitted with advanced degrees.

9. To a reliable degree, students who were admitted with some sort of financial aid (scholarships, fellowships) were less likely to incur probationary status than the students

who were admitted without such aid. Probationary scholarship
holders, however, were not meaningfully superior to probation-
ary non-scholarship holders in the mean number of warnings
received.

10. There was a predictive relationship between de-
gress earned at the University of Michigan and achievement.
To a reliable degree, the non-probationary students were more
likely to earn graduate degrees than were the probationary
students. Furthermore, the students who earned advanced
degrees received significantly fewer repeated warnings than
the students who did not earn degrees.

11. Foreign students were more likely to experience
academic difficulties during the first and second enrollments
than at any other time during their subsequent residence in
the graduate school. However, the incidence of probation
varied somewhat with the degree earned. Students who did
not earn degrees were not only more likely to experience
academic difficulties earlier in their graduate training
but also to incur disciplinary action more consistently than
the students who earned advanced degrees, particularly those
who were awarded doctorates. The warnings received by the
latter group were more randomly distributed over their entire
residence in the graduate school.

12. There was a significant relationship between
field of concentration and achievement. The largest per-
centages of probationary students were found in political
science, physics, economics, chemistry, and English. It

should be noted, however, that the probationary students in the several fields of concentration were essentially alike in the number of warnings received.

13. The field of concentration broadly classified was also significantly related to achievement. Students who majored in the social sciences and physical sciences were more likely to incur probation than were the students who majored in other broad academic areas. Probationary students in the several fields of concentration broadly classified, however, were essentially alike in the number of warnings received.

14. Student load was significantly related to achievement. Probationary and non-probationary students differed in the number of hours attempted and earned, especially during the first two enrollments in the graduate school. The great majority of non-probationary students were not only more likely to attempt but also to earn more hours during the first two enrollments. The fact that probationary students were more likely to attempt and earn a greater total number of hours, however, may be attributed to the additional courses probationary students took to offset deficiencies in their scholastic averages.

15. Length of residence in the graduate school was significantly related to achievement only at the masters level. The number of enrollments of probationary students who earned masters degrees was significantly greater than the number of enrollments of non-probationary students who earned similar degrees.

16. Attendance at summer school was not significantly related to achievement.

17. Probationary status was significantly related to the cumulative grade-point ratios of foreign graduate students. This would mean that probation was not of little consequence in the subsequent achievement of these students. To the contrary, disciplinary action reliably indicated the scholastic competence of the students upon whom it was imposed. The non-probationary students in each degree category had a significantly higher cumulative grade-point average than the probationary students in the corresponding degree categories.

18. The two major groups of students, probationary and non-probationary, were found to be significantly different in their performance on the Miller Analogies Test, the non-probationary students having the higher mean. A further analysis of student achievement according to native country broadly classified, broad area of study, and degrees earned at Michigan revealed few additional differences between probationary and non-probationary students. The non-probationary students who either came from Europe and the Far East, or were enrolled in the humanities, or earned masters degrees in the graduate school had significantly higher test scores than the probationary students in the same categories.

19. The entire array of probationary and non-probationary students differed significantly in the mean verbal ability score on the Academic Aptitude Examination, Graduate Level, the non-probationary students having the higher mean. The

only significant relationship between performance on the verbal sub-test and achievement in the various broad academic areas, however, pertained to students enrolled in the social sciences.

20. The numerical ability sub-test of the Academic Aptitude Examination, Graduate Level, had a more limited value than the verbal ability sub-test for predicting foreign student achievement. This sub-test did not differentiate the entire number of probationary and non-probationary students with any assurance. The only significant relationships obtained pertained to students who came from the Far East or who were enrolled in the engineering sciences.

21. There was a significant relationship between total score on the Academic Aptitude Examination, Graduate Level, and achievement. The mean total score for the entire number of non-probationary students was significantly greater than the mean total score for the probationary students. A few additional significant differences were obtained when students were further classified according to geographical area, broad area of study, and degrees earned at Michigan. Non-probationary students who were either from the Far East, or who were enrolled in the social sciences or engineering or who earned masters degrees had significantly higher mean total scores than the corresponding probationary students in these categories.

IMPLICATIONS

A project of this nature would be of limited value if there were not certain implications to be drawn from the

findings which could be of assistance to administrators,
teachers, counselors, and others who are interested in the
achievement of foreign students in American institutions.
Within the obvious limitations of the data, this study may
well serve as a starting point for a better understanding of
the academic difficulties experienced by foreign graduate
students. The implications which have emerged from this
study of foreign student achievement at the Horace H. Rackham
School of Graduate Studies may be enumerated as follows:

1. It would seem that the personnel who have the
responsibility of evaluating the credentials of foreign
student applicants are able to select, with some assurance,
those students who may later experience academic difficulties
in graduate school. That students who were admitted on a
provisional basis were more likely to incur disciplinary
action to a reliable degree than the students who were regu-
larly admitted casts some doubt upon the desirability of ad-
mitting applicants on a provisional basis. Administrators
might well reconsider the policy of granting provisional ad-
mission to foreign students who fail to meet one or more of
the requirements for regular admission to the graduate school.

2. No less than 176 or 86 per cent of the probationary
students in this study earned advanced degrees. It would
seem that the great majority of probationary students are
able to overcome any initial difficulty in making a satis-
factory adjustment to American educational standards. It is
therefore reasonable to infer that the graduate school is

justified in giving students who incurred probation a second chance.

3. The fact that the great majority of foreign students incurred disciplinary action early in their graduate training attests the need of a more concentrated orientation program. It must be remembered that, in most instances, foreign students are transplanted into a society quite different from the one they left. Differences in language, academic standards, and ways of behaving, as well as the lack of American friends are but some of the obstacles to a satisfactory adjustment. A carefully planned orientation program designed to acquaint incoming students with their new surroundings, the facilities available for their use, and the calibre of work required might well reduce the amount of academic failure.

4. The results on the Miller Analogies Test and the Academic Aptitude Examination, Graduate Level, would indicate that insufficient knowledge of the English language may account for much of the academic failure experienced by the foreign students whom we studied. A partial preventative would be a requirement that all non-English-speaking foreign graduate students pass an examination in basic English as a prerequisite to enrollment in a graduate course for credit. Students whose performance on such an examination is not satisfactory should be required to enroll in the English Language Institute to overcome the language handicap. This test could well be devised and administered by the English Language Institute of the University of Michigan.

5. It would seem that the Miller Analogies Test and the Academic Aptitude Examination, Graduate Level, which have been discontinued as a part of the admissions procedure, have some value in differentiating probationary and non-probationary foreign graduate students. The fact that these aptitude tests had predictive value for foreign student achievement is indicative of the need for further research in the possible utilization of these instruments as part of the evaluative process in selecting qualified foreign applicants.

6. The data argue for a more careful selection of the applicants from the Near East, Latin America, and the Far East. Similarly, foreign students who indicate a desire to enroll in the social sciences or physical sciences might be more carefully screened. While the data are by no means conclusive, it would seem that a language handicap might account for much of the failure experienced by these students.

7. Finally, if the awarding of an advanced degree be a criterion of success in the graduate school, by and large the achievement of foreign students is rather commendable. Of the 587 students included in this study, no fewer than 485 or 83 per cent achieved advanced degrees.

RECOMMENDATIONS

As a result of this study the following recommendations are offered as indicating problems to which future research might advantageously be addressed:

1. The present study has been largely concerned with

selected gross factors as they relate to the achievement of foreign students in a particular graduate school. It would be highly desirable if a similar study could be made, perhaps with a wider sample carefully selected from several graduate institutions, in which attention would be focused upon such basic characteristics as intelligence, interests, and personality. A testing program that would make available information on such matters could well be devised and might yield results that would provide a more complete understanding of the factors which influence the achievement of foreign students. But until such an extensive investigation can be made, the present results represent a rough substitute.

2. An interesting deviation from the procedure employed in this study might be an inquiry into the achievement of foreign graduate students without classifying them into probationary and non-probationary groups. If such an experimental design were used, it not only would allow the investigator to ascertain the interrelationships of the several factors employed in this project but to make a differential prognosis as well.

3. It seems to the writer particularly important that a comparison be made of the achievement of foreign students versus American students at the Horace H. Rackham School of Graduate Studies. He surmises that interesting differences would appear in the patterns of achievement of these two groups. Furthermore, such a study would undoubtedly suggest additional criteria which could be employed in screening

foreign graduate applicants.

4. It is further suggested that an investigation of foreign student credentials and their evaluation be under-taken. It is a well-known fact that a student's previous academic record is one of the better predictors of his subsequent achievement. The foreign institutions represented in this study differed so widely in the standards of grading that no attempt was made to ascertain the predictive value of the academic records reported by these institutions. In Chapter II we noted that numerous investigators are in accord concerning the need for a better understanding of the relative merits of the undergraduate training received by students in different foreign institutions. Productive research in this area would help administrators to determine the predictive significance of such training for successful graduate work in American colleges and universities.

5. A follow-up study of the foreign graduate students in the population with which we have been dealing would be of invaluable assistance in pointing out those areas in which the needs of foreign graduate students at the University are not being met. A questionnaire could be so designed as to elicit suggestions from the students themselves as to ways in which the graduate training could be improved.

6. Finally, it is the opinion of the writer that the role of counseling in the achievement of foreign students, particularly of those who experienced academic difficulties, be evaluated. In our project we noted that the mean number

of warnings incurred by the entire probationary group was
1.71, or approximately two. The data are silent, however,
as to the role played by counseling in reducing the amount
of academic failure. Such a study might well reveal the
relative strengths and weaknesses of the guidance facilities
available to foreign students in the Horace H. Rackham School
of Graduate Studies.

RECAPITULATION

The underlying purpose of this study has been to
secure facts that may lead to a better understanding of the
academic difficulties experienced by foreign graduate students
at the University of Michigan. The predictive relationship
of selected factors was ascertained and, within the obvious
limitations of the data, certain tentative conclusions and
their implications were indicated. Moreover, problems re-
quiring further research were suggested in order that
additional evidence be added to the meager amount of informa-
tion now available in this area.

In conclusion, it is hoped that some misconceptions
concerning the achievement of foreign students have been
cleared away and that attention has been focused on factors
that administrators will find helpful in their task of ad-
mitting only those foreign applicants who will profit most by
graduate study here.

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